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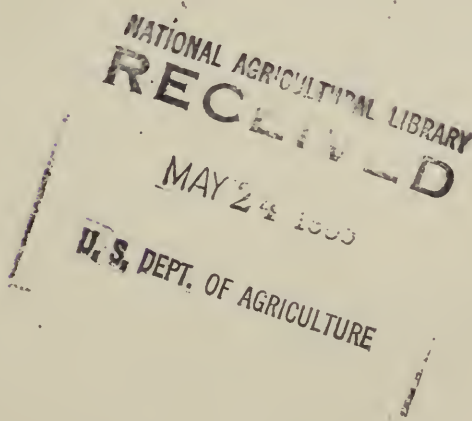


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"An Annotated Bibliography of Cotton Research at the Southern Utilization Research and Development Division," U. S. Department of Agriculture Miscellaneous Publication No. 893, lists titles and abstracts of publications and patents pertaining to cotton utilization research at the Southern Division from the establishment of the Southern Regional Laboratory through 1959.

Since that date, technical papers on cotton research have been published at the rate of about 100 per year. Patents have been obtained on a number of these developments. For the convenience of those who wish to keep up to date on the Division's cotton research, until such time as a supplement to the "Annotated Bibliography" is published, these later papers will be compiled into Cotton Publications Lists. CPL-1 lists publications for 1960-1961, and subsequent issues one year each.

Reprints of most of the papers are available and single copies may be obtained without cost by addressing a request to:

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**COTTON RESEARCH AT THE  
SOUTHERN UTILIZATION ;  
RESEARCH AND DEVELOPMENT  
DIVISION**

**COTTON PUBLICATIONS LIST  
CPL-1**

**1960-1961**

**Compiled and Edited  
by  
Marie A. Jones and Charlotte Duffy**

**Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE**

**Issued April 1962**



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## ABSTRACTS OF PUBLICATIONS - 1960-1962

1905. PNEUMATIC CLUTCH IMPROVES PICKER OPERATION [Older Machines Which Are Belt Driven From Line Shafts Can Now Be Provided With A More Efficient Means of Intermittent Drive] Latour, W. A., Textile Bull. 86, (1) 66-67. 1960.

The fabrication and operation of an air-actuated clutch that replaces the conventional belt shift mechanism is described. This clutch eliminates lag in the feed system and keeps the column of fiber in the reserve hopper at practically a constant level in contrast to about a twelve-inch fluctuation with a belt shifting unit.

1906. REPLY TO RUPERTI LETTER. Berard, W.; Gautreaux, G. A.; and Reeves, A. Textile Research J. 30, 70-71. 1960.

The paper "Formic Acid Colloid of Methylolmelamine as a Weather and Rot Resistance Finish for Cotton" was intended merely to present a practical method for producing cotton fabric with outstanding rot resistance and improved weather resistance. The paper was not intended to claim that the process or finish was superior to all other finishes, such as the Arigal finish, or to imply that this finish was the first use of an acid colloid of methylolmelamine. A brief description of the published processes are described for application of the acid colloid and of the Arigal finish to allow a comparison of the two processes. It is pointed out that the acid colloid finish for cotton fabrics is a practical method for producing fabrics with outstanding rot resistance and good weather resistance.

1907. RESEARCH IN ALL PHASES OF INDUSTRY WILL OPEN WIDER DOORS FOR COTTON. Kopacz, B. M.; and Knoepfler, N. B. Cotton Trade J. 40, No. 6, Sec. 2., 14. 1960.

Research relating to cotton utilization at the Southern Division is briefly described. Based on the current work at the Laboratory, predictions are made as to possible future developments. Some recent achievements are outlined.

1909. METHODS TO IMPROVE RESILIENCE OF COTTON PILE YARNS IN SOFT FLOOR COVERINGS. Abrams, Edward; Cox, Herbert; and Milner, Gladys. Am. Dyestuff Reprtr. 49, 34-39. 1960.

Various formulations of synthetic latex and dimethylol cyclic ethylene urea (DMEU) resin have been applied to cotton carpet yarns prior to the construction of carpets. An improvement in compressional resilience was obtained with a 60/40 mixture of a butadiene-high acrylonitrile latex and DMEU resin. However, this improvement, detectable on a subjective basis, was not detected by the compressometer method of testing. A modified test method, based on deformation in padder squeeze rolls, gave results that were more consistent with subjective evaluation of carpet pile resilience.

1913. THE EFFECT OF SOME TITANIUM WHITE PIGMENTS ON OUTDOOR COTTON DUCK. Brysson, R. J.; Reeves, W. A.; and Patton, E. L. Canvas Prods. Rev. 35, (10) 46, 47, 51. 1960.

This paper compares the phenomenon of accelerated tendering of fabrics treated with titanium pigments with the deterioration (chalking) of titanium dioxide-containing paint films. The authors conclude that wherever it is desired to use white pigments in contact with cotton fabric, the chalk-resistant modification of rutile titanium dioxide should be specified.

1915. LOCATION OF AREAS OF REACTION IN CHEMICALLY TREATED COTTON CELLULOSE. Tripp, V. W.; Moore, A. T.; deGruy, I. V.; and Rollins, M. L. Textile Research J. 30, 140-47. 1960.

The modification of cotton cellulose by environmental conditions or by chemical treatments for specific end uses ordinarily occurs at submicroscopic levels. Observations with the electron microscope have proved to be useful in delineating regions of the fiber cellulose affected by a variety of treatments, including dyeing, mercerization, acid and enzymatic hydrolysis, derivative formation, and resin impregnation. The appearance of fiber fragments treated in these ways or derived from treated fibers is illustrated and discussed.

1917. HOW MUCH WILL CM COTTON COST? Decossas, K. M.; McMillan, O. J.; Reinhardt, R. M.; and Pollard, E. F. Textile Inds. 124, (3) 90-93. 1960.

This preliminary cost study shows that it would cost as little as 2.5 cents per square yard to carboxymethylate cotton fabric into a product having modified properties, such as a built-in starched effect, increased water absorbability, and greater receptivity to further treatments. It also indicated that cotton yarn could be carboxymethylated into a water-soluble product with a potential for numerous applications at a cost of 41 cents per pound of product. These estimates are for new installations, and are based upon current costs of chemicals, labor, and utilities, and include overhead, insurance, taxes, depreciation, and other contingencies and general expenses. The cost of the cotton and a profit on the treatment are not included. The carboxymethylation can be carried out in standard processing equipment which is already available at many plants or can be readily obtained. The exception to this is the roller box which was designed to handle fabric for five minutes after padding, during reaction. In plants already having equipment of the type needed for partial carboxymethylation, the total manufacturing costs in Tables 1 and 2 could be less by as much as the depreciation cost, which represents about 65 per cent of fixed cost. The chemicals used are inexpensive and are produced in multi-ton lots by a number of chemical manufacturers. Partially carboxymethylated cotton is now in production at one American plant. Custom production on a commission basis is available.



1922. COTTON CROSS-LINKED AT VARIOUS DEGREES OF FIBER SWELLING.  
Reeves, W. A.; Perkins, R. M.; and Chance, L. H. Textile  
Research J. 30, 179-92. 1960.

Wet and dry density measurements were made on a wide variety of wash-wear cotton fabrics and some interpretations of these values are given. Methylenated cotton was selected for more extensive fundamental study because of the simplicity of the formaldehyde cross-link and the fact that formaldehyde can be reacted with cotton under greatly different conditions. Formaldehyde was used to cross-link cotton print cloth at various degrees of fiber swelling by reacting in systems ranging from completely aqueous to anhydrous using hydrochloric acid as catalyst. The amount of water in the system at the time of reaction is related to the extent of fiber swelling. The extent of swelling at the time of cross-linking and the extent of cross-linking influence wet density, which may be considered to be a measure of the water swellability of a fiber. Cross-linking tends to fix or stabilize a fiber in a given state of swelling; the stabilization is more effective when the cross-linking is done in nearly anhydrous systems. The state of swelling at the time of cross-linking modifies moisture regain, water of imbibition, dyeability, and wet and dry wrinkle recovery. There seems to be an optimum water content in the reaction system at the time of cross-linking for maximum dry and wet wrinkle recovery. As the water content in the reaction system is increased beyond the optimum, the amount of dry wrinkle recovery becomes much less than wet wrinkle recovery. This phenomenon leads to vastly different wash-and-wear ratings of fabric. A mechanism is presented diagrammatically to explain wet and dry wrinkle recovery. The mechanism is based upon hydrogen-bond cross-links, covalent-bond cross-links, and the position of the two types of cross-links.

1923. NEW SILICONE ALLOY FOR DURABLE WATER REPELLENCY ON COTTON.  
Conner, C. J.; Reeves, W. A.; and Chance, L. H. Textile Research  
J. 30, 171-78. 1960.

A new silicone alloy made by the simultaneous polymerization of tetravinyl silane and methyl hydrogen siloxane using benzoyl peroxide as a catalyst and methyl isobutyl ketone as a solvent is an excellent water repellent for cotton fabrics as measured by AATCC spray ratings. The treatment is very resistant to soap and detergent action. The alloy may be applied from organic solvents or aqueous emulsions. Greater permanence to laundering was obtained by the solvent method. Best results were obtained by first depositing zirconium oxide in the fabric by double decomposition using a zirconium salt and sodium hydroxide, then padding with either a methyl isobutyl ketone solution or an aqueous emulsion of the alloy and curing for 5 min. at 145°C. A satisfactory one-step process was also developed by incorporating zirconyl acetate or zirconium butoxide as catalysts in the treating solution or emulsion. Creaseproofing resins may also be incorporated in the formulation.



1924. FORMIC ACID COLLOID OF METHYLOLMELAMINE RESIN TREATMENT OF COTTON: PRELIMINARY COST STUDY. McMillan, O. J., Jr.; Decossas, K. M.; Berard, W. N.; Reeves, W. A.; Pollard, E. F.; and Patton, E. L. Am. Dyestuff Reprtr. 49, 180-81. 1960.

This preliminary cost study for the formic acid colloid methylolmelamine resin finish of cotton indicates a low cost for imparting, in a single treatment, both rot- and weather-resistance. Estimated cost of applying a 12% resin add-on varies from 6.7 cents down to 5.3 cents per yard of fabric. This is equivalent to a range of 18.7 cents down to 14.9 cents per pound of resin-finished cotton. The economies effected by operation of a plant at higher annual production levels is readily apparent from Table III. This process is quite suitable for the continuous processing of fabric on conventional textile equipment.

1926. DO YOUR CLEANING AT THE PICKER [SRRL carding cleaner makes clean laps from roughly harvested cotton at full picker production.] Kyame, G. J.; and Latour, W. A. Textile Inds. 124, (4) 127-31. 1960.

Evaluation of the SRRL Carding Cleaner under laboratory conditions indicates that this modification of the finisher section of a one-process picker enables the picker line to remove 50% of the trash in cotton, with a negligible loss of lint. There is no evidence of fiber damage, no increase in neps, and no impairment of yarn properties. The laps produced are well-felted, satisfactorily uniform, and card with about 5% less strips than do conventional laps. It appears possible that the installation of the Carding Cleaner in both stages of a two-beater, one-process picker could provide sufficient cleaning to satisfy the requirements of most mills. The opening room would then be limited to the bale opening and blending equipment needed to prepare the cotton for processing in the picker room. The Carding Cleaner is covered by U. S. Patents Nos. 2,810,163 and 2,825,097, which are licensed by the Department of Agriculture on a non-exclusive royalty-free basis. Engineering specifications and additional information may be obtained from the Southern Regional Research Laboratory, P. O. Box 19687, New Orleans 19, La.

1927. THE DIETHYLENETRIAMINE-CELLULOSE COMPLEX. Segal, Leon; and Loeb, Leopold. J. Polymer Sci. 42, 351-56. 1960.

Diethylenetriamine and cellulose form a stable complex with interplanar spacings of  $d_{101} = 11.54$ ,  $d_{10\bar{1}} = 4.53$ , and  $d_{002} = 4.18$  A. The spacings are almost identical to those of the ethylenediamine-cellulose complex. It is concluded from the x-ray data that the triamine molecule separates two cellulose chains and crosslinks them through the secondary and one primary amino group of the triamine.

1928. STUDIES OF THE ETHYLENEDIAMINE-CELLULOSE COMPLEX.II. STABILITY OF THE COMPLEX. Segal, Leon; and Loeb, Leopold. J. Polymer Sci. 42, 341-50. 1960.

The ethylenediamine-cellulose complex in the dry state has a sharp, characteristic x-ray diffraction pattern and usually contains from 17-26%



diamine when freshly prepared. High vacuum and elevated temperature failed to reduce this below 17%. Storage under uncontrolled conditions, however, caused rapid decomposition of the complex as evidenced by the changes in the x-ray pattern. Storage under controlled conditions of temperature and humidity resulted in a slow decrease in diamine content which was accompanied by shifts in the characteristic interferences of the x-ray pattern. Storage for fifteen weeks over dilute sulfuric acid was required to effect a complete loss of the characteristic x-ray pattern and to reduce diamine content to 8.6%. A sample of especially dried complex exposed to the open air showed a sharp increase in weight for the first 24 hr., which is attributed to absorption of moisture, and a subsequent, very slow decrease in weight, attributed to loss of diamine. Diamine content and x-ray data indicate that a 2:1 ratio exists between anhydroglucose units and diamine molecules, such that one diamine molecule crosslinks two cellulose chains through hydrogen bonding. Distortion of the unit cell in the 010 basal plane was calculated to be 57%, while a 40% increase was found in fiber cross-sectional area. The increases are of such an order of magnitude that most of the fiber swelling can be accounted for by complex formation.

1930. INFRARED SPECTRA OF CELLULOSE MODIFICATIONS. O'Connor, R. T.; McCall, E. R.; and Mitcham, Donald. Am. Dyestuff Reprtr. 47, 214-22. 1960.

The potentialities of the well-known potassium bromide disc technique for measuring the infrared absorption of cellulose and modified cellulose have been thoroughly explored. These investigations have led to the development of a specific procedure by which a high-quality infrared absorption curve of any cotton fiber, yarn or fabric can be obtained rapidly, simply, and reproducibly and, most important, without any modification of the sample during preparation or measurement. Details of the specific procedure will be given very briefly with a limited comparison of the results obtained with other methods which have been proposed earlier. Applications of the procedure show that chemical modifications of cotton can be detected, the character of the modification identified, and the extent of treatment quantitatively estimated. Examples of spectra will be shown to demonstrate the high quality which can be obtained, the reproducibility, and the fact that the sample is not modified during measurement, or preparation for measurement. Spectra will also be presented to illustrate applications to investigations of the well-known esterification and etherification modifications of cotton, to investigations of the newer type of replacement reactions, and to other newly developed modifications of cotton.

1931. AN INVESTIGATION OF INORGANIC SALTS AND OXIDES AS FINISHES FOR COTTON. Esteve, R. M., Jr.; Wright, G. E.; and Mack, P. B. U. S. Dept. Agr. ARS 72-15: 50 pp. 1959 (Processed.) Also published: Textile Research J. 29, 760. 1959 [Letter to the Editor.]

A search was made of the literature pertaining to the treatment of cotton with inorganic compounds to improve certain functional properties. From approximately 700 references, purportedly relating to this subject,



310 were selected as pertinent. These are cited in the text around certain specific topics and are arranged in alphabetical order in the bibliography. A systematic screening of oxides and salts of metallic elements as finishes which might improve certain of the functional properties of cotton was made. Seventy-four compounds, selected on the basis of their apparent insolubility, were applied to cotton, some of them in more than one concentration. The treated fabrics were tested for: Stability to leaching and laundering; effect on strength; changes in resistance to mildew and rot (soil burial), to outdoor weathering, to actinic degradation, to heat, and to burning; changes in thermal stability; and changes in water repellency. From the several compounds studied upon which previous findings had not been reported, the following nine were selected for further consideration: Aluminum hydroxide, beryllium oxide, cobaltous hydroxide, cobaltous metaborate, lead hydroxide, manganous oxide, manganous phosphate, manganous silicate, and nickelous phosphate. Outstanding among these were cobaltous metaborate and cobaltous hydroxide. Cobaltous metaborate-treated cotton was good in mildew and rot resistance, in outdoor weathering performance, in stability with respect to actinic exposure, and in resistance to atmospheric contaminants, and was good to excellent in water repellency. The cobaltous hydroxide-treated cotton was found to be good to moderate in resistance to mildew and rot and very good in outdoor weathering. It also imparted good resistance to actinic degradation and to atmospheric contaminants.

1935. ALDEHYDE-ETHYLENIMINE REACTION PRODUCTS AS FINISHES FOR COTTON FABRICS. Chance, L. H.; Perkins, R. M.; and Reeves, W. A. Textile Research J. 30, 305-11. 1960.

In an exploratory study the reaction products of ethylenimine with four aldehydes were evaluated primarily as wash-wear finishes for cotton fabric. Two dialdehydes, glyoxal and glutaraldehyde, and two  $\alpha,\beta$ -unsaturated monoaldehydes, acrolein and crotonaldehyde, were used in the study. One of the new finishing agents, the reaction product of acrolein and ethylenimine, imparted good wrinkle recovery to cotton fabric.

1936. EFFECT OF CELLULASE ON COTTON FIBER MICROSTRUCTURE. PART I: DEGRADATION BY CELLULASE IN FUNGAL GROWTH FILTRATES. Porter, B. R.; Carra, J. H.; Tripp, V. W.; and Rollins, M. L. Textile Research J. 30, 249-58. 1960.

Electron microscopical studies of changes in cotton fiber microstructure, after exposure of the fibers to the cellulase in filtrates prepared from cultures of Myrothecium verrucaria, showed evidence of the transverse, jagged cuts into the cellulose structure previously seen by optical microscopy. The degradation appeared localized in areas along the length of the fiber which were not related to any recognized component of fiber structure. Micrographs of fragmented, degraded fibers showed etching of the macrofibrils of the sheets of secondary wall and a sharpening of the image of the individual microfibrils. Continued enzyme attack produced smaller fragments and hydrocellulose-like particles. Measurements of changes in tensile strength, swelling in alkali, and in glucose yield were correlated with changes in microstructure. The extent of fiber degradation by cellulolytic culture filtrates was limited and could be continued only if fibers were swollen between filtrate exposures. No evidence of damage to the cellulose structure was seen which could not be explained by hydrolysis at the  $\beta$ -1,4-glucosidic linkage.



1937. EFFECT OF CELLULASE ON COTTON FIBER MICROSTRUCTURE. PART II: DEGRADATION DURING GROWTH OF CELLULOLYTIC MICROORGANISMS. Porter, B. R.; Carra, J. H.; Tripp, V. W.; and Rollins, M. L. Textile Research J. 30, 259-67. 1960 .

Electron microscopical studies were made of changes in cotton fiber microstructure on samples from cultures of the bacterium, Cellvibrio fulvus, and the fungus, Myrothecium verrucaria. Bacterial colonies, growing in the folds of the primary wall, caused diagonal or longitudinal splitting of the fiber surface. Degradation by the fungus was characterized by transverse cracks in the fiber wall. Other changes in fiber microstructure during microbial growth were similar for both organisms. In areas of intense attack, surface replicas showed single fibrils detached from the underlying structure; on mercerized fibers, hydro-cellulose-like particles on the surface at times obscured the surface structure. Fragmentation patterns indicated a continued breaking down of the fibrillar structure into small fragments and particles. The final degradation products, seen in electron micrographs, resembled particles produced by a limited, heterogeneous acid hydrolysis, but positive identification with hydrocellulose particles has not been made. Cottons modified to produce a more expanded microstructure with higher amorphous cellulose content showed large decreases in resistance to microbial attack. Attack by growing microorganisms was more intense and rapid than degradation by growth filtrates obtained from cultures of cellulolytic fungi, but the mode of degradation was similar.

1938. PHYSICAL PROPERTIES OF CHEMICALLY MODIFIED COTTONS. PART V: EFFECTS OF AMINIZATION. McDonald, A. W.; Humphreys, G. C.; and Grant, J. N. Textile Research J. 30, 312-17. 1960.

Yarns from six cottons selected for their widely different fiber characteristics were partially aminized to a degree of substitution averaging about 0.043. Yarns were allowed to contract in length during the chemical reaction but were placed under a small load during the washing and souring processes. Moisture regain and linear density were increased by the treatment. Modified cellulose density and fiber length were decreased. The changes in tenacity and modulus showed inconsistencies among samples of different cottons, with trends similar to those found in mercerization. Decreases in tenacity were found for the fiber bundles but increases for the yarns. The single fibers showed no appreciable changes in tenacity. Secant moduli of fibers and yarns were intermediate between those of slack and normal length mercerization.

1939. INTERLABORATORY STUDIES OF THE SHIRLEY ANALYSER METHOD. Little, H. W.; Fiori, L. A.; and Mayne, S. C., Jr. Textile Research J. 30, 319-21. 1960. [Letter to the Editor]

This "Letter to the Editor" of the Textile Research Journal brings into focus a few of the problems that may be faced by participants at the General



Plenary Sessions of the International Standards Organization on Textiles in England on May 19-21, 1960, in attempting to standardize the Shirley Analyser Method of estimating the amount of lint and trash present in cotton. The letter discusses an interlaboratory study of the Shirley Analyser Method conducted by the American Society For Testing Materials and another by the Swedish Institute of Textile Research made at the request of the International Federation of Cotton and Allied Textile Industries. Despite some differences in approach and analysis, results from both studies agree rather closely, especially with respect to average trash and lint contents and variability among and within these averages. The letter concludes that the wide variation in test results among laboratories would appear to limit routine use of this method in commercial transactions and for arbitration purposes. However, the rather good precision found within laboratories makes the method extremely useful for comparing within the same laboratory, trash and lint contents of different cottons, the same cottons cleaned by different equipment or cottons treated or selected in other ways.

1942. CROSS-SECTIONAL STUDY OF CHEMICALLY TREATED COTTON FIBERS.

Rollins, M. L.; Moore, A. T.; and Tripp, V. W. Intern. Conf.

Electron Microscopy, Berlin, Germany, 1958 Proc. 4, 712-15. 1960.

Ultrathin cross sections of cotton fibers mounted on carbon-coated specimen grids have been subjected to the action of reagents which dissolve cellulose. This technique has permitted following with the electron microscope changes in the behavior of cotton cellulose as a result of cross-linking, substitution and polymer impregnation. Using cupriethylene-diamine hydroxide as a swelling agent, cross-sections of untreated cotton fibers have been observed to dissolve whereas sections of fibers which have been treated with appropriate chemical cross linking agents swell and only partially dissolve. Furthermore, in cases where there has been extensive lateral cross-linking of the cellulose within the fiber there is phenomenally great swelling of the cross-section without any separation or rupture of morphological elements. In fibers in which previously introduced monomers have been polymerized within the fiber the swelling of the cross-section is considerably restricted. Similar observations on Fiber fragments complement these findings.

1943. CHOOSING THE BEST DRAFT. PART I. MEDIUM STAPLE COTTONS.

Simpson, Jack; Callegan, A. T.; and Sens, C. L. Textile Inds.

124, No. 5, 209-10, 213, 217, 219, 223, 225, 227. 1960.

The allocation of drafts between processes from picking through spinning required to produce optimum yarn strength and uniformity was investigated for three medium-staple cottons from different areas of growth. It was found that spinning draft had more effect upon yarn strength and uniformity than drafts at the other processes, although the latter had a significant effect upon these properties. The most significant trend observed for the processes prior to spinning was that a lightweight second-drawing sliver produces the most uniform 0.50 through 6.00 hank roving. It was noted that even though the cottons were from different growth areas, their optimum draft allocations were practically the same. In fact, their optimum spinning drafts were identical.



1944. COMING: THE PUSH-BUTTON MILL? Rusca, R. A. Textile World 110, No. 5, 46-47. 1960.

Although much technological progress has been made on textile processing machinery and methods, cotton textiles are still produced by a system originated 200 years ago, based on a concept of discontinuous, multistage processing steps. The author believes that a completely new, continuous processing system is needed, and outlines a 10- to 20-year program of basic and applied research that should result in the development of a scientifically-designed, fully-automated means for producing yarns and fabrics.

1947. AN APPROACH TO AUTOMATION OF A WRINKLE RECOVERY TESTER. Sloan, J. M.; Haydel, C. H.; Schultz, E. F., Jr.; and Weller, H. W., Jr. Am. Dyestuff Repr. 49, 302-04. 1960.

This paper describes the electronically-operated mechanisms which have been employed in an initial approach toward automation of the wrinkle recovery tester used in the vertical strip method (Monsanto) for measuring wrinkle recovery angles. Essentially it provides means for automatically adjusting the position of the specimen during the recovery period by means of a photoelectric cell. It also times and stops the test at the end of the test interval. Good correlation of results is obtained between it and the conventional Monsanto tester, using identical test procedures.

1948. A MEASUREMENT OF COMBING EFFICIENCY. Simpson, Jack; and Ruppenicker, G. F., Jr. Textile Bull. 86, (5), 103-06. 1960.

A method of measuring combing and detaching efficiencies is outlined and represents an improvement over existing methods. The combing and detaching efficiencies are based on the idea of dividing the percentage of noil fibers and sliver fibers in certain length groups by the percentage of fibers that should be in these length groups for perfect combing then weighing according to length group and expressing the resultant as a percentage. It is found that the combing and detaching efficiencies vary with the percent noils removed by the comber. The combing efficiency increases with increased noil removal, and the detaching efficiency decreases. When comparing the efficiency of combers, or combing methods care must be used in ascertaining that the percentage noils removed are the same and that any noted difference in the calculated efficiencies is not attributable to operator error in making the arrays.

1949. APPARENT ACTIVATION ENERGY OF HYDROLYSIS OF SOME CELLULOSIC MATERIALS. Nelson, M. L. J. Polymer Sci. 43, 351-71. 1960.

Apparent activation energies for heterogeneous acid hydrolysis of four samples of cellulose which differed in crystallinity were calculated separately for the amorphous and crystalline regions, from data obtained under drastic hydrolytic conditions. Some approximate activation energies were also calculated for hydrolysis of the amorphous fraction of cotton and a viscose rayon, using data obtained with a range of dilute acid concentrations. These values are discussed in relation to hydrolytic conditions.



The relations between the hydrolysis rate, the acidity function ( $H_0$ ), and the hydrogen-ion concentration, as well as the values of activation entropy were examined for evidence with respect to reaction mechanism. Data from the literature were used to show that the activation energy probably is temperature dependent.

1950. CONCERNING TERMINOLOGY FOR EMPIRICAL MEASUREMENTS OF CRYSTALLINITY. Segal, Leon; Creely, J. J.; and Conrad, C. M. Textile Research J. 30, 404. 1960. [Letter to the Editor]

An explanation and justification is given for the terminology used in a recent paper by the authors and A. E. Martin, Jr., to which O. Ant-Wuorinen objected. It is shown that the same terminology has already been used by several authors, contrary to the usage by Ant-Wuorinen, and even that one author has used another symbol to designate Ant-Wuorinen's "index."

1951. CHANGES IN FINE STRUCTURE AND MECHANICAL PROPERTIES INDUCED BY CYANOETHYLATION OF COTTON YARNS. PART I: TREATED WITHOUT TENSION. Conrad, C. M.; Stanonis, D. J.; Harbrink, Pieter; and Creely, J. J. Textile Research J. 30, 339-48. 1960.

Cotton yarns were impregnated with 6% sodium hydroxide and reacted in the relaxed state with acrylonitrile at 60°C. and different periods of time up to 60 min. to give products with degrees of substitution up to 2.6 cyanoethyl groups per anhydroglucose unit. As substitution increases the x-ray diffraction pattern shows only slight alteration until substitution has exceeded 1.1, after which the crystalline structure rapidly gives way to an amorphous structure, complete at about DS = 2.0. At the same time density decreases nearly linearly with substitution. At the stage where the product becomes essentially amorphous, it can be annealed at temperatures of about 175°C., into a new pattern characteristic of cyanoethyl cellulose. This annealing is accompanied by a substantial density increase. Stress relaxation of the cyanoethylated yarns at a substitution of 1.1 suggests a glass-rubber transition point about 140°C. which becomes more distinct and moves to lower temperatures as substitution increases. At a substitution of about 2.0 the stress relaxation reaches its lowest value (about 4% of the value at 20°C.) at the highest temperatures tested (220°C.). With further substitution a minimum relaxation at an intermediate temperature is followed by increasing stress as the temperature is raised. This effect is associated with crystallization. Breaking strength increases slightly at low substitutions but decreases then to less than 50% for the highest substitutions. Elongation at break increases gradually, exceeding 100% above the control at DS = 2 and above. Tensile stiffness decreases to about 3% of its initial value. Work of rupture and recovery show considerable decreases below DS = 2, but sharp rises between 2.0 and 2.6. Immediate elastic recovery is little affected below DS = 2, but rises above this. Delayed elastic recovery shows continuous improvement as substitution increases, eventually exceeding the control by nearly 50%.



1952. A COMPARISON OF SOME PHYSICAL PROPERTIES OF 80X80 PRINT CLOTH PRODUCED FROM THREE COTTONS DIFFERING PRIMARILY IN FLAT BUNDLE STRENGTH. Sands, J. E.; Fiori, L. A.; and Brown, J. J. Textile Research J. 30, 389-92. 1960.

Three cottons, representative of the main strength groups (high, medium and low) and having other pertinent fiber properties not substantially different, were processed into a standard 80X80 print cloth construction. The strongest-fibered cotton produced the strongest fabrics in the warp direction in the grey, bleached, and bleached and dyed states; however, in the filling direction this relationship did not hold for the bleached and bleached and dyed states. Elongation at break of fabrics (raveled strip) was apparently influenced more by mechanical treatment during chemical processing than by fiber properties. While tearing resistance of the fabrics appeared to be correlated with cotton fiber strength at zero gauge, there appeared to be no relationship between cotton fiber strength and fabric abrasion resistance except in the filling direction in the grey state.

1953. PREPARATION AND RATES OF HYDROLYSIS OF PERFLUORO-ESTERS OF CELLULOSE. Benerito, R. R.; Berni, R. J.; and Fagley, T. F. Textile Research J. 30, 393-99. 1960.

Partial esters of cellulose varying in degree of substitution from 0.02 to 0.58 were prepared by reacting cellulose immersed in dimethylformamide with either perfluorobutyryl chloride or perfluoro-octanoyl chloride in the presence of a tertiary aromatic amine. The use of essentially homogeneous solutions of acid chlorides resulted in products which retained properties of the original cotton and showed in addition oil and water repellency which was durable to dry cleanings and aqueous launderings in the presence of neutral detergents. Rates of uncatalyzed hydrolysis of the perfluoro-octanoyl cellulose esters were determined at 25°, 35°, and 45° C., and the rate of the alkaline-catalyzed hydrolysis was estimated at 25°C. The energy and entropy of activation for the uncatalyzed hydrolysis were determined.

1954. THE EFFECTS OF GAMMA RADIATION ON COTTON CELLULOSE. Arthur, J. C., Jr; Blouin, F. A.; and Demint, R. J. Am. Dyestuff Repr. 49, 383-88. 1960.

The effects of high energy gamma radiation on the properties of purified cotton cellulose, at several dosage levels ranging to 100,000,000 roentgens, were determined. The effects of radiation on the molecular properties of cellulose followed the relationship:

$$\ln P = k' \ln N_n + K'$$

where P is the molecular property;  $N_n$  is the total number of ionizations or total dosage of gamma radiation received in the system; and k' and K' are constants. The major structural changes, which occurred on irradiation of cotton cellulose, were the formation of carbonyl and carboxyl groups and the cleavage of the cellulose molecule. The fibrous structure of the cellulose disintegrated at dosages higher than five to 10 million roentgens with loss of textile properties.

1955. DIFFERENTIAL GINNING. EFFECTS ON COTTON FIBERS AND YARN PROPERTIES. Griffin, A. C., Jr.; McCaskill, O. L.; Tallant, J. D.; and Fiori, L. A. Cotton Gin & Oil Mill Press 61, (11): 19-20. 1960.

Differential, stage, or fractional ginning appears technically feasible and represents a practical method of obtaining cotton with less than average short fiber content at the expense of producing other cotton with a greater than average short fiber content. The economic desirability of differential ginning has not yet been determined and must await additional experimentation and an economic analysis of its effect on the entire cotton industry. The limited experiments, conducted so far, show that increases in short fiber content adversely affect the strength, appearance, and uniformity of the yarns.

1961. THE INFRARED SPECTRA OF UREIDES OF GLUCOSE AND LACTOSE. Segal, Leon; O'Connor, R. T.; and Eggerton, F. V. J. Am. Chem. Soc. 82, 2807-11. 1960.

Infrared absorption spectra have been obtained for glucose ureide, glucose ureide urea and lactose ureide. Tentative assignments of group vibrations have been made. Some evidence is present in the spectra which suggests that the sugar portion of the ureide molecule may be in the aldehydo-glucose configuration.

1962. PROCESSING RAMIE ON MILL EQUIPMENT. EVALUATING THE PROCESSING OF RAMIE FIBER ON STANDARD EQUIPMENT. Taylor, J. L.; and Herron, A. M. Textile Inds. 124, (6): 97-103. 1960.

This is a report of processing trials to develop methods for processing staple ramie fiber (Florida ramie) into yarn, with standard equipment. Employment of a substantive type chemical softening agent was found to improve the hand of the fiber and impart improved drafting properties. Electrostatic influences in fiber processing on the modified cotton system were virtually eliminated by appropriate softening treatment. Commercially practical yarn manufacture using standard equipment was not attained, however, in exhaustive trials using (1) a variety of cut staple lengths ranging from 1-1/2 to 3 inches; (2) a variety of chemical softener treatments; (3) different lots of ramie in which the degumming treatment was varied to improve removal of gums; and (4) different yarn manufacturing systems, viz., the modified cotton system, employing different roller drafting systems, and the woolen system. Satisfactory separation with a minimum of fiber breakage of ribbons of degummed ramie was obtained using standard equipment. A tendency of the ramie fibers to adhere to one another and resist roller drafting presented a major barrier to successful yarn manufacture. Poor continuity in the various yarn manufacture processes and linear irregularity of roving and yarns precluded determination of satisfactory ramie yarn manufacturing methods and constructions. Exploratory investigation of processing characteristics of staple ramie using another fiber as a carrier showed promise of considerable improvement in product uniformity and processing continuity.



1963. CHEMISTRY AND CHEMICAL TECHNOLOGY (D.Cotton). Knoepfler, N. B. New International Year Book 1959. Funk & Wagnalls, New York, 1960. Also, condensation anonymously as "Chemistry (Fibers and Fabrics)" in Universal Standard Encyclopedia Yearbook for 1959, 64. Funk & Wagnalls Unicorn Yearbook Service, New York, 1960. (Reprints not available.)

This paper describes recent advances in cotton technology including a brief resume of wash-wear, flame resistance, water and oil repellency, ion exchange, heat and rot resistance, and other chemical treatments. New developments in mechanical processing of cotton are also discussed.

PATENTS

1966. CARPET OR RUG SCRUBBING SYSTEM. U. S. Pat. No. 2,923,956, February 9, 1960. Bixler, M. E.

An integrated scrubbing machine for the "on location cleaning" of pile type floor coverings which consist of the following components: a suds generator, a rotary brush scrubbing element, and a suds-removal and foam-breaking element.

1967. CELLULOSE ANTHRANILATE TEXTILE FIBERS AND PROCESS FOR MAKING THE SAME. U. S. Pat. No. 2,926,063, February 23, 1960. Reeves, W. A.; and Wade, R. H.

Chemically modified cotton textile fibers produced by the processes disclosed, exhibit properties such as enhanced dye stuff affinity, reduced moisture affinity, enhanced chemical activity, mildew- and rot- resistance.

1969. FIBER CLEANER. U. S. Pat. No. 2,931,071, April 5, 1960. Young, R. C.; and Rusca, R. A.

A cleaner for textile fibers designed for removing trash such as sticks, etc., from ginned cotton.

1970. FLAME-RESISTANT CELLULOSIC TEXTILES AND PROCESS FOR REACTING CELLULOSE ETHER TEXTILES WITH AZIRIDINYL PHOSPHINE OXIDE OR SULFIDE. U. S. Pat. No. 2,933,367, April 19, 1960. Reeves, W. A.; Drake, G. L., Jr.; and Guthrie, J. D.

Flame-resistant textiles produced by the reaction of aziridinyl phosphine oxide or sulfide with chemically modified cellulose.

1972. FIBER CLEANER. U. S. Pat. No. 2,934,793, May 3, 1960. Kotter, J. I.; and Mayer, M., Jr.

A fiber cleaner for separating trash from cotton. The patented device relates particularly to a novel "spreader duct" conduit attachment.

1973. PROCESS FOR THE PRODUCTION OF ALKALI-SOLUBLE COTTON TEXTILE MATERIALS. U. S. Pat. No. 2,938,765, May 31, 1960. Reinhardt, R. M.; and Reid, J. D.

A process for producing alkali-soluble cotton textile materials involving an exceedingly mild chemical modification (etherification or esterification) followed by an oxidizing treatment that combines two oxidizing reagents, the combined effects of which are synergistic.

1974. N-EPOXYPROPYL PHOSPHORAMIDES AND METHOD OF PRODUCING SAME.  
U. S. Pat. No. 2,939,849, June 7, 1960. Frick, J. G., Jr.;  
and Arceneaux, R. L.

N-(2,3-epoxypropyl) phosphoramides, the polymers thereof and the  
processes for their preparation. Cellulosic textiles resin treated  
with these polymers exhibit flame resistance.



1976. EFFECT OF SHORT FIBERS IN COTTON ON SPINNING PERFORMANCE AND YARN PROPERTIES. Tallant, J. D.; Fiori, L. A.; Little, H. W.; and Leitz, L. A. Textile Inds. 124, (8) 129-33. 1960. Also, condensed version entitled "Studying Properties: Short Fibers, Real Trouble" Textile World 110, (7) 120-21. 1960.

While previous work had shown that short fibers (less than  $3/8$ ") were generally detrimental to yarn properties, their effect upon spinning efficiency had not been fully investigated. It is now shown that their effects are extreme and exponential as spindle speed is increased. Further, there are strong interactions among short-fiber content, spindle speed, yarn size and twist, with the adverse effect of high short-fiber content being minimized by increases in yarn size and twist, and by decreases in spindle speed. This indicates the desirability of giving consideration to the short-fiber content of a cotton when allocating it to cotton blends for different types and sizes of yarns. As an aid to the evaluation of the relative spinning performance of cottons containing different percentages of short fibers, a somewhat shortened test procedure was used. By efficient recording and handling of the data it appears that about 720 spindle hours are sufficient to determine the relative spinning efficiency within  $\pm 30\%$  at the 95% confidence level.

1977. EFFECT OF FABRIC STRUCTURE ON PROPERTIES OF WRINKLE-RESISTANT COTTONS Arceneaux, R. L.; Reid, J. D.; and Schultz, E. F., Jr. Textile Inds. 124, (9) 138-46. 1960. Also, condensed version entitled "Wrinkles and Weaves" Textile World 110, (7) 121-22. 1960.

Twenty-three cotton fabrics varying in one or more structural parameters were treated with a wrinkle-resistance agent, dimethylol ethyleneurea (DMEU), and also with the agent in a formulated treatment. The effects of the structural variables on crease recovery angle, tearing strength, breaking strength, and resin distribution were studied. Interactions of fabric properties with fabric direction necessitated a study of fabric properties on each direction rather than on the average or sum of both directions. The treatments tended to narrow the spread of crease recovery angle found in the untreated fabrics, bringing the crease recovery angle of each fabric closer to that typical of the treatment. The use of fancy rather than plain weaves caused an improvement in tearing strength properties. The use of coarser yarns also improved tearing strength properties. Distribution of resin content between warp and filling yarns was affected by variations in yarn twist multiplier. Breaking strengths of the various fabrics were not greatly affected by the structural variations in the fabrics.

1981. STUDIES OF WRINKLE RESISTANCE FINISHES FOR COTTON TEXTILES. I-- RELEASE OF FORMALDEHYDE VAPORS ON STORAGE OF WRINKLE-RESISTANT COTTON FABRICS. Reid, J. D.; Arceneaux, R. L.; Reinhardt, R. M.; and Harris, J. A. Am. Dyestuff Reprtr. 49, 490-95. 1960.

The evolution of formaldehyde from fabrics treated for wrinkle resistance with several N-methylol finishing agents has been studied and the



amounts of formaldehyde released on storage have been quantitatively determined. The effects of processing variables, such as time and temperature of cure, amount and type of finishing agent applied, type of catalyst used and the process wash following curing, have been investigated as related to the amount of formaldehyde produced. Also studied were the principal variables in storage, namely, time and temperature. The process wash after curing was found to have the greatest effect in reducing the amount of formaldehyde evolved from treated fabrics. It was shown experimentally that this was due to removal of residual catalyst by the wash. An accelerated storage test was used in the determination of formaldehyde evolution and the results were found to have excellent correlation with those of prolonged storage under normal conditions.

1983. EFFECTS OF CROSS-LINKAGE IN WRINKLE-RESISTANT COTTON FABRICS.

Frick, J. G., Jr.; Andrews, B. A. Kottes; and Reid, J. D.

Textile Research J. 30, 495-504. 1960.

The cross-linking of cellulose in cotton fabric with three wrinkle-resistance finishing agents has been investigated. The three agents used were dimethylol urea, dimethylol ethyleneurea, and formaldehyde. With all three compounds, maximum crease recovery angles are obtained with a substitution of 0.04-0.05 cross links per anhydroglucose unit. As crease recovery angles increase, the elongation and permanent set caused by an 8-kg. tensile load on a 1-in. fabric strip decreases. Permanent set approaches zero near 135° warp crease recovery. Changes in the load-elongation curves indicate elastic modulus increases as crease recovery angles increase. Treatment of fabric to the same crease recovery angles with the three compounds reduces tearing and breaking strengths to different extents. The differences are due to different amounts of cellulose degradation caused by the acidic catalyst systems and not to the structure of the cross links.

1984. PROPERTIES OF COTTON CONTAINING RADIATION-POLYMERIZED ACRYLONITRILE.

Arthur, J. C., Jr.; and Demint, R. J. Textile Research J. 30,

505-09. 1960.

The modification of the physical properties of cotton fiber, by exposing the fibers in the presence of acrylonitrile monomer, has been accomplished. Relatively large quantities of acrylonitrile monomer in aqueous zinc chloride were applied to cotton and radiation polymerized in the presence of the cotton. Microscopic examination indicated that the polymer was located within the fiber. There was only a slight decrease in breaking strength, a significant increase in elongation-at-break, and a decrease in stiffness of the fibers. Resistance to acid and to heat degradation of the yarn containing polyacrylonitrile was comparable to that of untreated yarn. A radiation dosage of 0.8 megarep gave a maximum add-on of polymer. The results are particularly interesting relative to the preparation of chemically modified cottons. Work will be continued to investigate the application of additional chemicals to cotton by high energy radiation and to evaluate the properties of these chemically modified cottons.



1985. EFFECTS OF GAMMA, HIGH-ENERGY ELECTRON, AND THERMAL NEUTRON RADIATIONS ON THE FIBRILLAR STRUCTURE OF COTTON FIBERS. Porter, B. R.; Tripp, V. W.; deGruy, I. V.; and Rollins, M. L. Textile Research J. 30, 510-20. 1960.

Changes in the structure of cotton fibers after exposure to gamma, high-energy electron, and to thermal neutron radiations, in various ambient atmospheres, were evaluated by the techniques of optical and electron microscopy. Radiation exposures evaluated were: gamma rays,  $10^5$  to  $4 \times 10^8$  r.; 2-Mev electrons,  $5 \times 10^4$  to  $10^8$  rep; integrated thermal neutron fluxes,  $5 \times 10^{14}$  to  $10^{17}$  nvt. Changes in the physical and chemical properties of similarly irradiated fibers have been, or are to be, reported in other publications. All irradiated, unmodified cottons could be differentiated from exposed cottons by optical microscopical observations of samples stained in Nile Blue Sulfate. Gamma ray and electron exposed samples differed from unexposed fibers in swelling behavior in 0.2M. (in Cu) cupriethylenediamine hydroxide, but thermal-neutron-irradiated cotton differed from the control only after exposure to an integrated flux of  $10^{17}$  nvt. Electron micrographs of the fibrillation patterns exhibited by fibers exposed to gamma and electron radiation doses of  $5 \times 10^6$  to  $10^8$  r. or rep on beating in water in a Waring Blendor showed the formation of increasingly smaller fragments of samples. Some shortening of fibrils and an increase in number of broken ends of microfibrils were seen in neutron-irradiated cotton exposed to  $10^{17}$  nvt; at lower integrated neutron fluxes, fibrillation was unchanged. No distinct differences were found in microscopical tests between gamma and electron irradiated fibers or between gamma-exposed fibers irradiated in oxygen and nitrogen. At doses of  $4 \times 10^8$  r. of gamma rays, the trend toward smaller fragments reversed and short chunks of material were observed. Varying amounts of degradation were observed in modified cottons after irradiation. Smaller fragments were observed in cottons modified to change and reduce the total crystalline cellulose; the fibrillation of acrylonitrile-treated cotton appeared unchanged, but irradiation produced a decrease in the size of fragments of dichloropropanol- and dimethylol cyclic ethyleneurea-modified samples.

1986. STUDIES OF WRINKLE RESISTANCE FINISHES FOR COTTON TEXTILES. II-- EFFECT OF STORAGE ON PROPERTIES OF "WASH-AND-WEAR" COTTONS. Reid, J. D.; Reinhardt, R. M.; Kullman, R. M. H.; and Arceneaux, R. L. Am. Dyestuff Repr. 49, 527-31. 1960.

The properties of some "wash-and-wear" cotton textiles are adversely affected by prolonged storage prior to reaching the consumer. In the present study, the effects of storage of fabrics treated with five types of N-methylol finishing agents were investigated. Chlorine resistance, breaking and tearing strength, and wrinkle resistance were determined. The process wash after curing was found to be a critical factor affecting



the durability of desirable properties of the finished fabric to storage. Particularly vulnerable to degradation by storage was the chlorine resistance of fabric treated with dimethylol ethyleneurea and the wrinkle resistance of fabric treated with a pyrimidinone derivative when the fabric was not afterwashed. Cotton treated with a triazone or melamine derivative also showed increased chlorine damage when not washed before storage.

1990. A COMPARATIVE WEATHERING STUDY OF DIFFERENT METAL 8-QUINOLINOLATES (A Report of CPAI-SURDD Cooperative Research Program)  
Patton, E. L.; Berard, W. N.; and Brysson, R. J. Canvas Prods. Rev. 36, (4) 26, 64, 65. 1960.

Ten laboratory prepared metal-8-quinolinolate compounds were applied to 8 oz. duck and 80x80 print cloth and the treated fabrics exposed to twelve months weathering. The effects of the metal-8 compounds are compared with a commercial copper-8 and the parent compound, 8-hydroxyquinoline on the basis of color, mildew inhibition and fabric strength retention after exposure. Aluminum-8 and zinc-8 were light in color (yellow tan and light yellow, respectively) and imparted mildew resistance to the treated duck. Cobalt-8 (cream tan) gave a fair degree of sunlight protection. The laboratory-prepared copper-8 afforded mildew resistance and was much lighter in color than the commercial grade of copper-8. The dark colored commercial compound on duck provided the highest strength retention after exposure and was free from visible mildew.

1992. REACTION OF EPICHLOROHYDRIN WITH AMMONIA, ANILINE, AND DIETHANOLAMINE. McKelvey, J. B.; Webre, B. G.; and Benerito, R. R. J. Org. Chem. 25, 1424-28. 1960.

The reaction of epichlorohydrin with ammonia, aniline, and diethanolamine in various reaction media has been investigated. The hydrochloride of N,N,N-tris(3-chloro-2-hydroxypropyl) amine and N,N,N-tris(2-3-epoxypropyl) amine have been prepared from the crude reaction product of ammonia and epichlorohydrin in a 1:3 mole ratio in methanol. Formation of 1-3-dichloro-2-propanol, when ammonia or ammonium chloride and epichlorohydrin are treated in aqueous medium, has been demonstrated. N-(3-Chloro-2-hydroxypropyl) aniline, N-(2,3-epoxypropyl) aniline, and N,N-bis(2,3-epoxypropyl) aniline have been isolated. N-(3-Chloro-2-Hydroxypropyl)-N,N-bis(2-hydroxyethyl)amine has been prepared and it has been demonstrated that this compound slowly forms a quaternary salt probably by cyclization.

1994. LINEAR DENSITIES OF FIBERS IN SELECTED LENGTH GROUPS OF 42 DOMESTIC AND FOREIGN COTTONS. Sands, J. E.; Louis, G. L.; and Tallant, J. D. Textile Research J. 30, 619-20. 1960.

It was shown that of 42 different cottons including both American and foreign growths, in the preponderant number of cases, the shorter length groups have lower linear densities than the intermediate groups. Also, the longest groups have lower linear densities than the intermediate groups.



1995. DURABILITY OF OLEOPHOBICITY OF COTTON FABRICS IMPARTED BY FLUORO-CHEMICALS. Berni, R. J.; Benerito, R. R.; and Philips, F. J. Textile Research J. 30, 576-86. 1960.

Durability of oleophobicity imparted to cotton fabrics by additive finishes (perfluoro-metallic complexes and perfluoro-acrylate) and by the incorporation of fluorochemicals into the cellulose molecule by means of an ether linkage has been investigated. Studies have been made on the relative effectiveness of additive finishes in maintaining oleophobicity during weathering. Results of soil burial tests involving the use of aluminum triacetate and perfluorooctanoic acid on various fabric constructions are reported. Various techniques used in efforts to improve durability of the latter finish to aqueous launderings are described. Data are presented to explain losses in oleophobic properties when fabrics treated with perfluorooctanoic acid complex of chromium or aluminum are subjected to aqueous launderings. The preparation of 1,1-dihydroheptafluorobutoxyhydroxypropyl, 1,1-dihydropentadecafluorooctoxyhydroxypropyl, and 1,1,7-trihydrododecafluoroheptoxyhydroxypropyl ethers of cellulose are described. The first two possessed hydrophobic and oleophobic properties durable to alkaline aqueous washings and commercial drycleaning solutions. The latter possessed only a small degree of oil repellency due to the presence of an omega-hydrogen atom.

1996. THE SRRL GRANULAR CARD. Rusca, R. A. Can. Textile Seminar. Book of Papers 7, 69-72. 1960.

Fundamental investigations at the Southern Regional Research Laboratory of the aerodynamics of cotton cards revealed that carding is a mechanical action, with air forces playing a very minor role. Data are presented on air pressures at strategic points with the card idling and processing cotton. The studies led to the development of a method of carding whereby the conventional revolving flats are replaced with a nonmoving, rigid granular surface that eliminates all flat waste. Design details and comprehensive pilot-scale evaluations of the Granular Card are discussed in full. Experimental installations of 1 to 8 converted cards are being evaluated by about 60 mills. Results are presented on the performance of Granular Cards in mills processing coarse, medium, and fine yarns.

2006. COTTON FABRIC WITH WET WRINKLE RECOVERY PRODUCED WITH FORMALDEHYDE WITHOUT EXCESSIVE STRENGTH LOSS. Reeves, W. A.; Perkins, R. M.; and Chance, L. H. Am. Dyestuff Repr. 49, 639-44. 1960.

The crosslinking of cotton fabric with formaldehyde while in a water swollen state was studied with the object of producing by a practical method a fabric having good wet wrinkle recovery without excessive degradation of fabric strength. This was accomplished in a pilot plant by padding the fabric through an aqueous solution of formaldehyde and hydrochloric acid and allowing to react in the wet state at room temperature by 1) remaining on the roll, 2) plaiting into a box (referred to as a J box process). After the required length of time (five to 20 minutes) the fabrics were given an alkaline process wash, and dried. Bleached mercerized fabric was found to be more suitable than bleached fabric in



the process because a given degree of wet wrinkle recovery was acquired at a faster rate and a lower level of combined formaldehyde. Also the final tear strength, and breaking strength, which were much greater with the mercerized fabric, were well within a practical range. Fabrics treated by this process had good wet wrinkle recovery only, and would be of practical use only when line dried. Preliminary experiments indicated that cotton fabrics which were reacted to a low degree with formaldehyde and then topped with a small amount of crease-proofing resin (in the range of 2.5%) such as a triazone, had as much initial wet and dry wrinkle recovery as was obtained with about 5% of the same resin on the original cotton fabrics.

2012. FABRIC STRUCTURE AND WASH-AND-WEAR. [Influence of Fabric Structure on Tear Strength of Resin-Treated Cotton Fabrics] Stravrakas, E. J.; and Platt, M. M. Textile Inds. 124, (10) 141-60. 1960.

Analytical determination of the causes of the loss in tear strength exhibited by the principal types of commercial cotton fabrics following resin treatment showed the following: that large losses in tearing strength result from the preparatory finishing processes, i.e., desizing, scouring, bleaching, and dyeing; that scouring was largely responsible for this loss in tearing strength; that commercially resinated fabrics exhibit both losses and improvements in tearing strength; that the fabric structural types that exhibited significant reductions in tearing strength also had large losses in yarn strength and slight changes in the number of threads rupturing per peak; but that the structural types exhibiting higher tearing strength displayed significant increase in the number of threads rupturing per peak (an indication of improved yarn mobility) and considerably less reduction in yarn tensile strength. Theoretical and empirical analyses indicate that the tearing strength of cotton fabrics may be improved through structural changes which increase the mobility of the yarns in the plane of the fabric, by increasing yarn strength, or by a combination of these factors, and that improvements in tearing strength may be obtained through one or more of the following: use of weaves with longer floats, use of more open textured fabrics, use of opposite twists in warp and filling yarns, and use of coarser, stronger yarns. Using these structural variations, a series of 31 experimental fabrics, including the 4 controls, were produced and resin treated to determine the extent of improvements realized in the 4 principal types of cotton fabrics (print cloth, broadcloth, twills and sateens) which are commercially resin treated. The analyses of this series of fabrics show the following: that preparatory treatments generally had a more deleterious effect on tearing strength than did the resin treatment; that the structural variations which gave enhanced yarn mobility or those containing stronger yarns yielded fabrics with improved tearing strength; and that structural variations which resulted in improved tearing strength did not adversely affect drape, tensile strength, abrasion resistance, and crease recovery.

2013. CLEANING COTTON BY AIR. Hetherwick, R. A.; and Weller, H. W.  
Textile Inds. 124, (10) 163-65. 1960.

Research at the Southern Regional Research Laboratory on an improved system for cleaning cotton in textile mills has resulted in development of an aerodynamic type cleaner for use with the SRRL Opener-Cleaner. The new cleaning unit increases the cleaning efficiency of the Opener-Cleaner by one-third without adverse effects on fibers or yarns. The unit adds little to the original cost of the Opener-Cleaner, but does require a greater air supply than that available from conventional textile mill condensers with integral fans.

2015. RECENT IMPROVEMENTS IN TEXTILE PROCESSING MACHINERY AND METHODS.  
Rusca, R. A. Textile Research J. 30, 685-91. 1960.

Recent developments by the Southern Regional Research Laboratory in the field of cotton textile processing machinery and methods are presented. Research on blending mature and immature cotton, the effect of short fiber content on processing efficiency and product quality, the SRRL Opener-Cleaner and the Carding Cleaner, and the new SRRL Granular Card are discussed. A plan is outlined for future research directed toward the development of a completely new method of manufacturing textiles that should materially improve quality and lower cost of cotton products.

2016. HIGH ENERGY  $\gamma$ -IRRADIATION OF VINYL MONOMERS. II. INFRARED SPECTRA OF RADIATION-POLYMERIZED ACRYLONITRILE. Arthur, J. C., Jr.; and Demint, R. J. J. Phys. Chem. 64, 1332. 1960.

The sharp bands were: 3.4, 6.8, and 7.4 $\mu$ , -CH<sub>2</sub>; 4.5 $\mu$ , -CN; 8.0 $\mu$  -CH; 9.3 $\mu$ , -C-CN. The change in structure of the radiation-polymerized acrylonitrile at higher dosages (ranging from 5.2 to 520 x 10<sup>21</sup> electron volts per liter from cobalt-60) was probably that resulting from a dehydrogenation followed by crosslinking between two or more polymeric molecules.

2018. AN S.R.R.L. REPORT ON THE VARIABILITY IN ELONGATION-AT-BREAK OF COTTON YARNS. Louis, G. L.; Flori, L. A.; and Little, H. W.  
Textile Bull. 86, (9) 101-04. 1960.

The findings of this exploratory investigation indicate that yarn elongation variability is inversely proportional to yarn elongation, single yarn strength and yarn toughness but directly proportional to yarn strength variability. However, the variability in yarn strength cannot be used in place of yarn elongation variability and that variability in yarn elongation should be considered as another index of processing efficiency.



2021. A REVIEW OF COST ANALYSIS IN AGRICULTURAL UTILIZATION RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION. Decossas, K. M.; Pollard, E. F.; and Patton, E. L. U. S. Dept. Agr. ARS 72-22, 16 pp. 1960 (Processed).

Cost research at the Southern Utilization Research and Development Division of the U. S. Agricultural Research Service has been aimed at the evaluation of new and improved processes and products from utilization research on cotton, cottonseed, peanuts, tung, rice, fruits, vegetables, sugarcane and naval stores. Results of arm chair cost estimates, preliminary cost estimates, and complete cost analyses are given. These results reveal that many of the new cotton chemical processes studied and developed at the Southern Regional Research Laboratory are inexpensive and show promise for commercial adoption. The cotton chemical processes evaluated include partial acetylation, full acetylation, aminization, partial carboxymethylation, carbamoyl ethylation, the THPC-methylolmelamine, APO-THPC, APO, and formic acid colloid of methylolmelamine resin treatments, hydroxyethylation, phosphonomethylation and wash-wear. Costs calculated for producing gossypol and cocoa butter-like fat from cottonseed oil, and tung oil-resin varnish vehicle are also discussed.

2022. PREPARATION OF PARTIALLY BENZHYDRYLATED COTTON CELLULOSE. Stanonis, D. J.; and King, W. D. Textile Research J. 30, 802-03. 1960.

No suitable methods for the benzhydrylation of cellulose, particularly without loss of the fibrous structure, could be found in the literature. Several possible methods were therefore investigated. Aqueous alcohol, a reaction medium found especially useful in the preparation of benzyl cellulose from soda cellulose and benzyl chloride was found to be unsatisfactory. Also, unsatisfactory was pyridine, a medium suitable in the preparation of trityl cellulose; the reactions with benzhydryl chloride or bromide were negligible. Preferential reaction of the halides with these media, rather than with the cellulose took place. On the other hand, quite satisfactory reaction occurred when 2,6-lutidine was employed as the reaction medium. Both benzhydryl chloride and bromide reacted readily with the cellulose.

2023. THE EFFECT OF SHORT FIBERS IN A COTTON ON ITS PROCESSING EFFICIENCY AND PRODUCT QUALITY. PART II: YARNS MADE BY MINIATURE SPINNING TECHNIQUES FROM DIFFERENTIALLY GINNED COTTON. Tallant, J. D.; Fiori, L. A.; and Landstreet, C. B. Textile Research J. 30, 792-95. 1960.

The conclusions reached by means of miniature spinning techniques with very small samples of cotton were similar to those obtained in Part I: changes in short fiber content do not affect the twist required for maximum strength but do lower strength somewhat more than 1% for each 1% increase in short fiber content. These samples covered an exceptionally

wide range of short fiber contents, from less than 1% to almost 20% by weight of fibers  $\frac{3}{8}$  in. and shorter. The very low short fiber content cottons were produced by careful hand ginning techniques while the remainder were obtained by differential ginning techniques.

2024. CHOOSING THE BEST DRAFT. PART II -- SHORT STAPLE COTTONS.  
Simpson, Jack; Callegan, A. T.; and Sens, C. L. Textile Inds. 124, (11) 101, 104-05, 108-09, 115. 1960.

This study deals with the determination of the optimum draft allocation between processes from picking to spinning when processing short staple cottons. It was found that short staple cottons were not as sensitive to draft allocations prior to spinning as were the medium and long staple cottons. The most significant trend prior to spinning was that of a light weight second drawing sliver producing the most uniform .50 through 6.00 hand rovings. The findings indicate that if optimum spinning conditions are used, draft allocations prior to spinning are relatively unimportant. However, if high spinning drafts are used, the draft allocations prior to spinning become increasingly more important. The study also indicates that many mills are employing too high a spinning draft for their coarse yarns, while for the finer yarns their draft is probably not high enough.

2025. ION EXCHANGE CELLULOSES FOR CHROMATOGRAPHIC SEPARATIONS.  
Guthrie, J. D.; and Bullock, A. L. Ind. Eng. Chem. 52, 935-37. 1960.

Cellulosic ion exchangers have been used extensively in the chromatographic separation of amino acids, proteins, enzymes, nucleic acids, hormones, and viruses. Recent work on the preparation, properties and uses of chemically-modified celluloses having ion exchange properties is reviewed. Methods are described for making an ion exchanger such as aminoethylated and diethylaminoethylated cellulose; and cation exchangers such as sulfoethylated, phosphorylated and phosphonomethylated cellulose. Excessive swelling and solubility of certain cellulose derivatives having ionic groups sets an upper limit on the ion exchange capacity of materials suitable for chromatography. It is shown that crosslinking of the cellulose prior to or during the chemical modification permits the attainment of higher ion exchange capacities while maintaining physical properties that appear to be suitable for chromatographic columns or for the preparation of paper. Various ways of crosslinking cellulose for this purpose are described. In some instances the same reagent may crosslink and introduce ionic groups. An example of this type is the reaction of dichloroacetic acid with cellulose in the presence of sodium hydroxide to introduce carboxyl groups.



2030. REACTION OF COTTON CELLULOSE WITH EPOXIDES IN THE PRESENCE OF ACID CATALYSTS. McKelvey, J. B.; Webre, B. G.; and Benerito, R. R. Am. Dyestuff Reprtr. 49, 804-09. 1960.

Ease of reaction of cellulose and various available epoxides in the presence of hydrogen ion catalysts and Lewis acids is considerably different from results obtained previously with base catalysis. Only a few monoepoxides add to cotton in the presence of cold dilute mineral acid in the case of ethylene oxide, the addition being about 10 percent of that obtained in the presence of hydroxyl ion. Diepoxides tested were also rather inert in the presence of hydrogen ions, the best (butadiene diepoxide) adding to cotton only about half as much as the best monoepoxide (butadiene monoepoxide). Under conditions of cationic catalysis (Lewis acid), especially with zinc fluoborate, it has been found that only two monoepoxides react with cotton. In the case of diepoxides, some of which are known to be very active, it was shown that crease resistance may be imparted to cotton at very low add-on by butadiene diepoxide, and that several diepoxides tested while producing good enough add-on failed to impart dry crease resistance. When epoxides which are known to add to cotton by zinc fluoborate catalysis are reacted under optimum conditions of base catalysis, it was found that the base-catalyzed samples exhibited only good wet crease resistance.

2031. PREPARATION OF TRIALLYLPHOSPHINE OXIDE. Chance, L. H.; and Guthrie, J. D. J. Appl. Chem. 10, 395. 1960.

The details of the preparation of triallyl phosphine oxide by the Grignard method from phosphorus oxychloride and allyl magnesium bromide are reported. The compound is a colorless oil with the following physical properties: b.p.,  $78^{\circ}/0.1$  mm; m.p.,  $18-18.5^{\circ}\text{C}.$ ;

$n_D^{30}$ , 1.5010;  $d_4^{30}$ , 0.9689; surface tension  $30^{\circ}$  (DuNuoy), 30.74 dynes/cm.; molecular refraction, 51.65.

2033. DEGRADATION OF COTTON IN AN OXYGEN ATMOSPHERE BY GAMMA RADIATION. Blouin, F. A.; and Arthur, J. C., Jr. J. Chem. Eng. Data 5, 470-75. 1960.

Purified cotton sealed in an oxygen atmosphere was irradiated with gamma rays to a total dosage of  $10^8$  roentgens. The major structural changes which occurred on irradiation were the formation of reducing and acid groups and the cleavage of the cellulose chain. During irradiation oxygen reacted with the cellulose, and other gases were evolved. The principal gases evolved were hydrogen, carbon monoxide and carbon dioxide. The irradiated cotton was fractionated into samples having different molecular weights using water and 90% ethanol as solvents. The acid groups were found to be predominantly present in the low molecular weight fractions, while the reducing groups were

fairly evenly distributed between the various fractions. The fractions were examined with respect to ultraviolet spectroscopy (220-350  $m_{\mu}$  range), infrared spectroscopy and other qualitative and quantitative techniques. The low molecular weight fractions were examined by paper chromatographic methods. The lowest molecular weight fraction was found to contain: glucose, cellobiose, cellotriose, cellotetraose, cellopentaose, cellohexaose, other oligosaccharides, arabinose, 2-ketogluconic acid, glyoxal and at least eight other components. The data were discussed with respect to the mechanism of degradation of cellulose in an oxygen atmosphere by gamma radiation.

2036. THE SRRL COBALT-60 FACILITY. Arthur, J. C., Jr.; Blouin, F. A.; and Demint, R. J. U. S. Dept. Agr. ARS 72-21, 7 pp. 1960.

The SRRL cobalt-60 facility, including design, installation, operation, and safety, was described. A bibliography of published research reports of the useful applications of nuclear energy made by SRRL to agricultural utilization research, particularly cotton research, was included.

2042. FA COTTON FABRIC: PRELIMINARY COST STUDY. McMillan, O. J., Jr.; Decossas, K. M.; Cooper, A. S., Jr.; Hamalainen, C.; Murphy, A. L.; and Pollard, E. F. Am. Dyestuff Repr. 49, 839-42. 1960.

FA cotton, a chemically modified cotton in which acetyl-groups are introduced into the cellulose molecule, has excellent electrical insulating properties, rot resistance, heat resistance, and flat abrasion resistance. This product may be prepared from cotton in raw stock, yarn, and fabric form. In this cost study we have considered cotton in only fabric form having a degree of substitution of 2.0, that is, an average of two of the three hydroxyl-groups per anhydroglucose unit has been replaced by acetyl-groups. Details of the process and hypothetical plants are described for producing this fabric product in 500 yard batches using conventional textile processing equipment. Investment costs, operating costs, and general expenses are given for plants with annual capacities of from 125 thousand linear yards up to 2.1 million linear yards. It was determined in this cost study that at the present stage of process development, a fabric product, having a DS of 2.0, can be produced at a cost of 55.5¢ down to 28.3¢ per linear yard, or \$1.30 down to 66.3¢ per pound of product. Captive supply or contract purchasing of chemicals and future process improvements could probably reduce these costs by as much as one-third.

2048. EQUIPMENT COSTS. Decossas, K. M.; Koltun, S. P.; and Patton, E. L. Chem. Eng. Progr. 56, (12) 60-63. 1960.

Agricultural utilization research is offering industry numerous processes for producing new and improved products from cotton, oilseeds, citrus, pine gum, rice, and other farm commodities. These processes are comprised



of a variety of unit operations, and have been evaluated over a wide range of productions based on both hypothetical and commercial operations. Equipment costs, largely obtained from equipment manufacturers during the past six years, and used in the process evaluations, have been adjusted to the December 1959 level, classified for the various equipment units by material of construction and size, charted, and are presented for quick reference and use.

2049. IMPARTING WRINKLE RESISTANCE TO COTTON WITH 1,1'-CARBONYLBISAZIRIDINE. Chance, L. H.; Perkins, R. M.; and Reeves, W. A. Textile Research J. 30, 918-26. 1960.

Cotton print cloth and broadcloth were made wrinkle resistant by treating with carbonylbisaziridine (CBA) by the conventional process of padding, drying, and curing. Data are presented for fabric treated with and without the use of an acid catalyst, zinc fluoborate. An aftertreatment with Primenit VS emulsion increased the crease recovery angle. Monsanto crease angles of over 300° were obtained with resin add-ons as low as 4.5%. In general the Elmendorf tearing strength was reduced 40-50%. This was improved somewhat by the use of a softener. The finish was quite stable to home laundering. When no catalyst was used in the solution, a reduction in breaking strength was observed after the chlorine bleach and scorch. When freshly prepared CBA solutions containing zinc fluoborate were used, there was no reduction in the strength of fabric after the chlorine bleach and scorch. However, all fabrics containing the finish were discolored in the scorched areas.

2050. BLENDING COTTONS DIFFERING WIDELY IN MATURITY. PART II: EFFECT ON THE PHYSICAL PROPERTIES OF A SHEETING FABRIC (TYPE 128). Fiori, L. A.; Louis, G. L.; and Sands, J. E. Textile Research J. 30, 926-33. 1960.

This investigation compares properties of a Type 128 sheeting woven with yarns spun from a blend of fibers differing widely in fiber fineness with comparable properties of a similar sheeting woven with yarns spun from a control cotton of the same average fineness. The data demonstrate that blending fine with coarse fibers in proportions of 60% to 40% does not detrimentally affect the important physical properties of grey, bleached, and bleached and dyed fabrics. Commercial acceptability evaluations showed that, in general, marketable bleached materials can be manufactured from a blend of extremely fine and coarse fibers. The dyed fabrics were not generally commercially acceptable due to nep imperfections. These findings, which showed that cotton fibers differing extremely in fineness can be utilized successfully when blended properly, revealed that the generally accepted opinion of unsatisfactory processing performance of blends containing fibers of widely different finenesses may be due to the inadequacy of present blending systems and methods rather than the properties of the fibers.

2051. SOME STUDIES ON THE CROSS-LINKING OF COTTON CELLULOSE. PART I: CHEMICAL AND PHYSICAL ASPECTS. Perkerson, F. S.; Reeves, W. A.; and Tripp, V. W. Textile Research J. 30, 944-54. 1960.

The currently-used types of cross-linking agents and some of their effects on cotton are discussed. The primary weaknesses or shortcomings of the finishes achieved with these agents are pointed out. It can be concluded either that the ideal cross-linking agent for cotton has not been found or that the best technique of application has not yet been discovered. However, considerable success is being had in producing minimum-care fabrics by the use of many cross-linking agents, especially the N-methylol type. Although cross-links through primary covalent bonds are largely responsible for the observed physical changes in cross-linked cotton fiber, secondary valence cross-links also may produce significant changes, some of which appear to be rather durable. Evidence is presented which indicates that polymer formation produced concurrently with cross-linking improved the over-all minimum-care properties of cotton fabric, although polymer formation alone does not improve the wrinkle recovery. Cross-linking agents which are capable of forming thermosetting resins generally are required in somewhat larger add-ons to produce wrinkle recovery angles in the practical range than are those agents that do not form thermosetting resins. The extent of permanent set is related to the extent of cross-linking. Moisture regain and density of the cross-linked cottons are more dependent upon the state of fiber swelling at the time of cross-linking than upon the extent of cross-linking.



PATENTS

2053. FIBER CLEANER. U. S. Pat. No. 2,951,265, September 6, 1960.  
Kotter, J. I.; and Mayer, Mayer, Jr.

This invention relates to a fiber cleaner especially adapted for removal of trash, such as sticks, etc., from ginned cotton fibers, and has among its objects the provision in such a cleaner of a simple and efficient combing cylinder which operates to open with little fiber damage bunches of fibers to permit more readily ejection of the trash.

2055. PROCESS OF TREATING NATIVE CELLULOSE WITH A LIQUID  
ALKYLENEPOLYAMINE AND A TEXTILE RESIN. U. S. Pat. No.  
2,955,014, October 4, 1960. Segal, L.; Loeb, L.; and Conrad, C. M.

A process for reducing the crystallinity of native cellulose fibers (enlarging the crystalline unit cells) by treatment with primary alkylene polyamines. This process achieves the reduction of crystallinity of native cellulosic fibers without degradation of the fibers.

2056. CENTRIFUGAL FANS. U. S. Pat. No. 2,956,736, October 18, 1960.  
Mayer, Mayer, Jr.; and Kotter, J. I.

An airfoil cutoff applicable to centrifugal fans and blowers, which cutoff greatly decreases noise and improves fan efficiency.

2059. HOW YOU CAN ENGINEER FOR FABRIC STRENGTH. [The effect of yarn properties and fabric structure on the grab breaking strength of fabrics---a statistical evaluation]. Sands, J. E.; Little, H. W.; Fiori, L. A.; Faught, W. A. Textile Inds. 125, (1) 52-54. 1961.

Skein and grab breaking strength data and certain elements of fabric construction which were derived from an analysis of 145 fabric structures, including plain, twill, sateen, and oxford weaves, and which were developed under another study, were analyzed. A number of simple correlations were tried which did not yield any coefficients of merit for further consideration. Multiple correlations were made based on the multiple regression effects of yarns per inch, yarn number, skein breaking strength and yarn crimp or grab breaking strength. Regression equations, based on these factors, were developed for both warp and filling directions and these for both plain woven fabrics only and for all fabrics on which necessary data were available. In three of these four cases, yarns per inch ranked most important. Yarn number ranked second in both warp and filling directions for the plain weaves, but third for all weaves. Skein breaking strength ranked first in importance for filling yarns for all weaves, second for warp yarns for all weaves, and third for both warp and filling for plain weaves. Yarn crimp was the least important in all cases.

2067. A SURVEY OF THE EFFECT OF LIGHT ON COTTON AND OTHER CELLULOSIC FABRICS. Robinson, H. M.; and Reeves, W. A. Am Dyestuff Reprtr. 50, 17-31. 1961.

This critical review covers the literature on the effect of light on cotton and other cellulosic fabrics from April 1948 through December 1959. Light with its spectrum and study divisions is described and shown on a graph. Studies on the theory of the degradation of cellulose by light are described as: (1) photolysis, (2) photosensitization, and (3) heat. Methods of testing and measuring changes in strength and color of fabrics are given. Methods prevention of light damage are discussed under the headings: (1) Purification and (2) Chemical modification of the cellulose. Under the latter, there are listed antioxidants, non-metals, metals, their oxides and hydroxides, pigments, miscellaneous organic compounds, and resins. One hundred thirty-one references and one graph are given.



2069. BLENDING COTTONS DIFFERING IN FIBER BUNDLE BREAK ELONGATION.  
PART I: EFFECT ON THE PROPERTIES OF COMBED SINGLE YARNS.  
Louis, G. L.; Fiori, L. A.; and Sands, J. E. Textile Research  
J. 31, 43-51. 1961.

Two long staple cottons, differing in fiber bundle break elongation but having other pertinent fiber properties substantially equal, were blended in different percentages to permit a study of the effects of break-elongation on yarn properties and spinning efficiency. Yarn strength and elongation were affected by fiber elongation, with fibers having the highest fiber elongation exerting the greatest influence. Furthermore, nep formation increased linearly as the percentage of higher elongation cotton increased in the blend, indicating that neps are directly influenced by average fiber stiffness. It was also found that yarn toughness index correlated closely with yarn impact data, thus suggesting its possible substitution for yarn impact data. The inconsistency of end breakage of the warp and filling yarns during spinning offered no conclusive evidence as to the relative spinnability of the cottons and cotton blends investigated.

2070. A PROCESS FOR THE MODIFICATION OF COTTON WITH FORMALDEHYDE.  
Chance, L. H.; Perkins, R. M.; and Reeves, W. A. Textile  
Research J. 31, 71. 1961.

A Letter to the Editor which describes two practical methods of imparting wrinkle recovery to cotton with formaldehyde. One method imparts wet wrinkle recovery only; the other, wet and dry wrinkle recovery. Physical properties of fabrics treated by both methods are given.

2071. THE ATTACHMENT OF ACTIVE HYDROGEN COMPOUNDS TO CELLULOSE WITH DIVINYLSULFONE. Welch, C. M.; and Guthrie, J. D. Textile  
Research J. 31, 84-86. 1961.

A general method of attaching active hydrogen compounds to cotton cellulose with simultaneous crosslinking of the cotton has been developed. Attachment of amines, phenols, amides, alcohols, ketimines and sulfur compounds has been effected. The addition of such materials to one vinyl group of divinyl sulfone and reaction of cellulosic hydroxyl

groups with the remaining vinyl group of the sulfone has given a wide variety of new cellulose ethers in fabric form. The use of preformed adducts of divinyl sulfone avoids the inhalation toxicity and lachrymation problems in using free divinyl sulfone. The process is rapid and facile, involving oven-curing with alkaline catalysts. The attachment of dyes and starch while imparting high wet wrinkle resistance was demonstrated. Useful levels of dry wrinkle resistance were obtained only in special cases.

2072. CHANGES IN THE PROPERTIES OF PARTIALLY PHOSPHONOMETHYLATED COTTON CAUSED BY CROSSLINKING PRIOR TO PHOSPHONOMETHYLATION.

Hobart, S. R.; Drake, G. L., Jr.; and Guthrie, J. D. Am. Dyestuff Repr. 50, 92-96. 1961.

Crosslinking the cellulose of cotton fabrics with dichloropropanol prior to phosphonomethylation with disodium chloromethyl phosphonate made possible a higher degree of substitution without loss of fabric structure. Crosslinked cotton print cloth and sheeting were phosphonomethylated (both once and twice). The DS increases over non-crosslinked phosphonomethylated fabrics were approximately 25 and 50%, respectively. Flame resistance, cation exchange capacity, resistance to microbiological degradation, and moisture content increased approximately in proportion to the increase in DS. Furthermore, prior crosslinking produced fabrics with significantly less stiffness, and nearly normal air-permeability. Pilot-plant equipment was used for all of the treatments.

2074. THE DETERMINATION OF CARBOXYL GROUPS IN CELLULOSE AND OXIDIZED CELLULOSE. Epstein, J. A.; and Lewin, Menachem. Textile Research J. 30, 652-55. 1960.

Methods for the determination of carboxyl groups in cellulose are based on the cation exchange capacity of these groups. In the available methods, estimation may depend on cation exchange with calcium, sodium, silver or methylene blue. In all the methods, the cellulose is brought into contact with a solution of a salt containing the cation to be exchanged. Analysis may be based either on the estimation of the anion liberated, or the cation left in solution. In some cases the cation which has reacted with the cellulose is estimated directly. In the present study nine different methods were examined using two samples of purified cotton, a sample of purified and bleached cotton linters and two samples of oxycellulose prepared by oxidation of the cotton linters with alkaline hypobromite. The relative merits of the different methods are discussed in the light of the results obtained. This work forms part of the research being carried out at this Institute under grant number FG-Is-101-58 issued by the Agricultural Research Service, United States Department of Agriculture.



2079. CHOOSING THE BEST DRAFT. Simpson, Jack; Callegan, A. T.; and Sens, C. L. Textile Inds. 125, (3) 93-94. 1961. "Letter to the Editor."

This article is a reply to a "Letter to the Editor" by W. Nutter concerning the article "Choosing the Best Draft" published in the May 1960 issue of Textile Industries. The several subjects discussed shows that Mr. Nutter was in general agreement with the findings in the article. It brings out that uniformity is not the sole indication of card sliver quality, but that within the range of drafts and doublings used in the study it was by far the dominant factor. It points out that the optimum draft distribution between the roving and spinning processes depends on the potential of the drafting systems at the individual process to maintain fiber control. However, it is shown that improving the drafting system of the roving or spinning processes would not necessarily change the optimum draft distribution between these processes, but would increase yarn uniformity and strength.

2080. HOW TO MAKE PA COTTON. Sens, C. L.; Sloan, W. G.; and Cooper, A. S., Jr. Textile Inds. 125, (3) 101, 105, 107, 109, 113, 115, 116. 1961.

Investigations were conducted to determine the optimum percentage of partially acetylated (PA) cotton to blend with untreated cotton for processing into yarns and fabrics. It was found necessary to use a blend of 70% PA and 30% untreated cottons to obtain relatively good heat resistance and mechanical processing. This blend was processed into a fabric for comparison with other fabrics produced from acetylated roving, acetylated yarn, and acetylated fabric. These comparable fabrics were evaluated by physical property measurements before and after heating for various periods at 160° C to determine at what stage of mechanical processing acetylation should be performed. On the basis of these simulated service tests, fabrics acetylated in fabric form or as yarn were slightly better than the fabric produced from a blend of acetylated and untreated cotton. While various techniques for acetylating raw stock, roving, and yarn have been developed on a pilot plant scale, fabric acetylation is still preferable from a commercial standpoint. However, many industrial fabrics are either too tightly woven or too wide for acetylation as piece goods. For these types of fabrics, acetylation in yarn form would be the preferred method of treatment.

2081. COTTON FIBER WEIGHT DISTRIBUTION. Fiori, L. A.; Sands, J. E.; Louis, G. L.; and Tallant, J. D. Textile Research J. 31, 178-80. 1961.

Data were presented to show that the errors in linear density determinations resulting from faulty arraying was relatively small. Also, it was found that average of differences in linear density between pairs of

length groups was either statistically significant or highly significant. Furthermore, data show that the chances are less than 1 in 100 that operators would diverge by 1 microgram/inch even in the least accurate determination of fiber fineness by the Suter-Webb array method.

2083. APPLICATION OF THE APO-THPC FLAME RETARDANT TO COTTON FABRIC. Drake, G. L., Jr.; Beninate, J. V.; and Guthrie, J. D. Am. Dyestuff Repr. 50, 129-34. 1961.

A typical laboratory and commercial procedure for the application of the APO-THPC flame-retardant to cotton fabric is given. The finish can be readily applied to cotton using commercial equipment, the resulting fabric properties being comparable to those of fabrics processed in the pilot plant. Commercial processing by various finishers necessitated some modification in the laboratory technique to adapt it to existing equipment. The functions of the various components of the treating solution and the necessary precautions to be observed during fabric processing are discussed.

2084. MILLS REPORT SAVINGS OF 1-4% CARD WASTE WITH USE OF THE S.R.R.L. GRANULAR CARD. Rusca, R. A.; Miller, A. L.; and Brown, R. S. Textile Bull. 87, (3): 114-16. 1961.

The cotton textile industry is evaluating granular carding on a wide scale. Reports from mills indicate savings of 1 to 4% card waste, without affecting mill processing efficiency or yarn uniformity or strength. In some cases a slight increase in trash particles may detrimentally affect yarn appearance. There is some evidence that granular carding is more suitable for coarse and medium yarns than for fine yarns. Maintenance on the granular conversion apparatus is negligible.

2085. A NEW AGE FOR KING COTTON. Kopacz, B. M.; Hoffpauir, C. L.; and Bourdette, V. R. Canvas Prods. Rev. 36, (11): 32-33, 76-77. 1961.

A general review of cotton research accomplishments at the Southern Utilization Research and Development Division is presented together with a discussion of the possible effects on textile markets of future work on luster, resistance to soil, stain, fire and mildew, improved warmth properties and easy-care qualities. Commercially available non-woven products are briefly reviewed.

2086. PROCEEDINGS. CONFERENCE OF COLLABORATORS FROM SOUTHERN AGRICULTURAL EXPERIMENT STATIONS--"WASH-WEAR COTTONS: REPORT OF PROGRESS AND CURRENT STATUS. March 28-30, 1960, New Orleans, La.

A brief survey of the research program of the Southern Division was presented also as were reviews of SU research on oilseeds and industrial



crops and on food crops. The collaborators attending the conference were chosen by the Directors of the Southern Agricultural Experiment Stations on the basis of their interest in the subject. Selected representatives of pertinent industries and government organizations, together with members of the professional staff of SU, participated in the deliberations of the conference. This Proceedings presents in summary or in full the discussions of the participants.

2087. STUDIES OF WRINKLE-RESISTANCE FINISHES FOR COTTON TEXTILES. III. AN ACCELERATED STORAGE TEST FOR "WASH-AND-WEAR" COTTON FABRICS. Arceneaux, R. L.; Gautreaux, G. A.; Reinhardt, R. M.; and Reid, J. D. Am. Dyestuff Repr. 50, 163-66. 1961.

An accelerated test procedure to determine the effect of storage on "wash-and-wear" cotton fabrics was developed. Fabrics finished with five N-methylol finishing agents, each with three different catalysts, were stored for 16 hours in sealed jars at 60°C and 100% relative humidity. The effects produced were comparable to those of prolonged normal storage. Optimum test conditions were established by determining the effect of storage time and temperature on fabrics finished with dimethylol ethyleneurea and zinc nitrate catalyst.

2088. NEW EQUIPMENT FOR OPENING AND CLEANING COTTON. Rusca, R. A. Cotton Trade J., Intern. Yearbook, 1960-61 Ed. 28, 264 (Jan. 20, 1961) (No reprints available).

The development of new and improved textile processing equipment to raise the quality and lower the cost of cotton products is an essential part of the research program of the U. S. Department of Agriculture to increase the utilization of cotton. The Department's machinery research is located at the Southern Regional Research Laboratory, New Orleans, La. Both fundamental and applied studies are conducted. Because an increasing percentage of the cotton crop is being mechanically or roughly hand harvested--61% in 1959--research has been concentrated on meeting the acute need for improved textile equipment to adequately clean these high trash content cottons. This program has resulted in the development of the "SRRL" series of textile machines--including the Opener, Carding Cleaner, and, more recently, the Opener-Cleaner and Aerodynamic Cleaner.

2094. DIMETHYLOLTRIAZONE FINISHING AGENTS WITH LONG-CHAIN ALKYL SUBSTITUENTS FOR COTTON TEXTILES. Vail, S. L.; Frick, J. G., Jr.; Murphy, F. J., Jr.; and Reid, J. D.. Am. Dyestuff Repr. 50, 200-04. 1961.

Three new triazones, with n-octyl, n-dodecyl, and n-octadecyl groups as 5-substituents, have been prepared. Dimethylol derivatives of these triazones were examined as reactive finishing agents for cotton fabrics. Of these, only the one derived from octyltriazone produced wrinkle resistance. The degree of wrinkle resistance was low and it is concluded

that this molecule is too large for more than partial access to the fiber and can, therefore, produce only limited wrinkle resistance. The dimethylol derivatives of the dodecyl- and octadecyltriazone were too large to give wrinkle resistance but did react to give a softening effect to the fabric. The octadecyltriazone produced only a small amount of water repellency whereas the other agents produced less or none at all.

2100. COSTING THE APO-THPC FINISH. Decossas, K. M.; McMillan, O. J., Jr.; Drake, G. L., Jr.; Reeves, W. A.; Pollard, E.F.; and Patton, E. L. Textile Inds. 125, (4) 135, 149-50, 155, 157-58, 162. 1961.

Resistance to fire is important in consumer products utilizing almost 2 billion pounds of cotton and other fibers annually in numerous end uses. With the APO-THPC resin treatment there has been developed a new and improved flame retardant finish for cotton, satisfactory for cotton fibers and cotton fabrics of all weights. The product has outstanding fire retardant characteristics, exhibits little or no change in hand, texture, appearance, or loss in strength, and is shrink-, rot-, and mildew-resistant. The finish is already being applied by numerous textile finishing mills to produce small yardages of cotton and cotton-synthetic blends for military research studies and customer acceptance studies. This cost study shows that based on long-range projected chemical prices for APO and THPC of 30 cents per pound, estimated processing costs for finishing 8-oz cotton twill to a resin add-on of 10 percent by continuous operations in a hypothetical plant at a processing rate of 120 yd per min, are as low as 7 cents per linear yd or 4.2 cents per sq yd. A decided advantage is that the process can be accomplished in the usual equipment for resin finishing.

2101. ADD CLEANING TO YOUR SRRL OPENER. Mayer, Mayer, Jr.; and Kotter, J. I. Textile Inds. 125, (4) 69-72. 1961.

An Aerodynamic Cleaner has been developed for use with the SRRL Cotton Opener. Installation of this relatively simple cleaning device on the Opener results in approximately 20% increase in opening line cleaning efficiency without adversely affecting the fibers or yarns. Pilot-scale evaluations indicate the combined Opener--Aerodynamic Cleaner would permit the elimination of one cleaning machine from the processing line without sacrificing over-all cleaning efficiency.

2103. COTTON CANVAS GOODS RESEARCH ENTERS NEW ERA. Brysson, R. J.; and Bourdette, V. R. Canvas Prods. Rev. 36, (12): 34-35, 46-47. 1961.

A brief, popular review of the cooperative canvas products research program conducted at the Southern Division by the Division and the Canvas Products Association International and the National Cotton Council of America from the program's inception.



2105. AMINIZATION OF COTTON--COST ANALYSIS APPLICATION. Koltun, S. P.; Decossas, K. M.; Drake, G. L., Jr.; Pollard, E. F.; and Patton, E. L. Am Dyestuff Repr. 50, 241-44. 1961.

AM cotton, a chemically modified cotton in which aminoethyl groups are introduced into the cellulose molecule, has excellent affinity for wool-type acid dyes, good ion-exchange capacity, and a high degree of reactivity. This reactivity lends itself to further chemical modification. Cost data are provided that are needed for considering the feasibility of producing AM cotton. Investment and processing costs are compared with those reported in an earlier cost article. A number of variables were considered in this analysis, such as chemicals cost and processing rates. This analysis is based on treating 52-inch wide 80 x 80 print cloth, 3.1 linear yards per pound, by continuous operations in a hypothetical plant, at a processing rate of 120 yards per minute. Only conventional textile processing equipment is required for this process. It is estimated that after considering the more important variables, processing costs would range from 5.2 cents per yard or 3.6 cents per square yard at an annual production of 60.5 million yards to 6.2 cents per yard or 4.3 cents per square yard at an annual production of 14.4 million yards.

2108. THE in Situ POLYMERIZATION OF ETHYLENE UREAS AND ETHYLENE AMIDES WITHIN THE FIBERS OF COTTON. Jones, F. B.; Hammon, H. G.; Leininger, R. I.; and Heiligmann, R. G. Textile Research J. 31, 57-65. 1961.

A new approach to cotton finishing has been investigated, involving a study of various diaziridinyI compounds, as potential cross-linking agents for cotton cellulose to produce "minimum care" or "wash-wear" fabric finishes. Over 25 different aziridinyI compounds were prepared experimentally and screened for utility on the basis of water solubility and effect on such fabric properties as crease-recovery angle, tear strength, breaking strength and elongation, flex abrasion, washfastness, and chlorine retention. The experimental finishes were applied to an 80 x 80-count cotton print cloth, using laboratory-size padding and drying equipment. The diaziridinyI compounds based on aliphatic diisocyanates and bischloroformates were found to demonstrate the greatest utility for the contemplated application, particularly those compounds prepared from hexamethylene-1,6-diisocyanate and mono- and diethylene glycol bischloroformate precursors. Increases in crease-recovery angle in the range of 30-60% were achieved with these finishes under conditions of application generally similar to those employed for commercial polymethylol type finishes. While these particular diaziridinyI finishes impart considerable crease resistance to cotton cloth, they were found generally to cause less impairment of other fabric properties than an experimentally-applied commercial polymethylol cotton finish (CEU resin). The diaziridinyI finishes, being nitrogen-containing compounds, demonstrate a strong tendency to retain chlorine after chlorine bleaching. Further development of curing techniques for application of these finishes should be considered as a possible means of reducing chlorine retention.



2111. STUDIES ON THE CROSS-LINKING OF COTTON CELLULOSE. PART II. MICROSCOPICAL OBSERVATIONS. Tripp, V. W.; Moore, A. T.; and Rollins, M. L. Textile Research J. 31, 295-301. 1961.

The response of cross-linked cotton fibers to beating in water, enzymatic hydrolysis, and exposure to cellulose solvents has been examined by electron microscopy. Cross-linking by primary bonds between cellulose chains confers stability of the cellulose structure toward mechanical and chemical attacks of these types. Cross-links introduced when the fiber is in the unswollen state are more effective in stabilizing the cellulose than those established when the cotton is swollen. The significance of the observations is discussed.

2112. INVESTIGATION OF THE CATALYST IN THE CELLULOSE-DMEU REACTION. PART I: EFFECT OF CATALYST UPON THE PHYSICAL AND CHEMICAL PROPERTIES OF THE FINISHED COTTONS. Ziifle, H. M.; Berni, R. J.; and Benerito, R. R. Textile Research J. 31, 349-65. 1961.

Cotton print cloth (80x80) has been treated with 8% solutions of DMEU in the presence of inorganic salt catalysts at constant molar concentration of the metallic ion. The four catalysts employed-- $MgCl_2$ ,  $Zn(NO_3)_2$ ,  $Mg(NO_3)_2$ , and  $ZnCl_2$ --were studied at 0.006M, 0.03M, and 0.1M concentrations. A comparative study has been made of the physical and chemical properties, swelling behavior as revealed by microscopical techniques, and infrared absorption spectra of all specimens. It has been found that absorption spectra differ with treatment, depending on the absence or presence of a catalyst; that the catalyst enters into the reaction; and that the final properties of the treated fabrics are influenced by catalyst concentration. Consideration is also given to the effect of catalyst upon chlorine damage.

2113. FORMALDEHYDE TREATMENT OF PARTIALLY SWOLLEN COTTON. Chance, L. H.; Perkins, R. M.; and Reeves, W. A. Textile Research J. 31, 366-76. 1961.

Two processes for producing wash-wear cotton fabrics by treatment with formaldehyde are described. One of these processes consists of reacting the fabric in a wet swollen condition in an aqueous solution of formaldehyde and hydrochloric acid. This fabric has good wet wrinkle recovery only and is therefore referred to as the Form-W process. It has good strength retention and is suitable for line-drying after washing. The other process consists of reacting the fabric in a wet, partially swollen condition in a solution of acetic acid, water, hydrochloric acid, and formaldehyde. It is referred to as the Form-D process because the fabrics have good dry (as well as wet) wrinkle recovery. These fabrics are suitable for either line-drying or tumble-drying. It is very important in both processes that the fabrics be well mercerized if adequate strength is to be retained. Softeners also improve the tearing strength. Laboratory and pilot-plant applications are described, and data on the physical



properties of the fabrics presented. Reaction rates of the Form-D process at various temperatures are given. Also, preliminary work on other solvents and catalysts is discussed briefly. Cross-linking with formaldehyde at various degrees of fiber swelling is discussed briefly from a theoretical standpoint.

2114. COTTON WASH-WEAR RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION. U. S. Dept. Agr., Agr. Res. Service, Sou. Util. Res. and Dev. Div. (1961) (Compiled by Marie A. Jones, New Orleans, La.).

An abstract bibliography of publications and patents of the Southern Utilization Research and Development Division on wash-wear, and on cross-linking and other phenomena basic to wrinkle resistance and other wash-wear properties.

2115. HEAT-, MILDEW-, AND ROT-RESISTANT COTTONS (Acetylated or Cyanoethylated). U. S. Dept. Agr., Agr. Res. Service, Sou. Util. Res. and Dev. Div. 1961. (Compiled by Marie A. Jones, New Orleans, La.)

An abstract bibliography of publications and patents reporting research by the Southern Utilization Research and Development Division on acetylation and cyanoethylation of cotton fabrics. Included in this listing are some papers on the treatment of cotton with acrylonitrile in the presence of gamma radiation.

2116. MECHANICAL PROCESSING OF COTTON. U. S. Dept. Agr., Agr. Res. Service, Sou. Util. Res. and Dev. Div. 1961. (Compiled by Marie A. Jones, New Orleans, La.)

An abstract bibliography of 170 published papers reporting results of research on the mechanical processing of cotton by the Southern Utilization Research and Development Division. Included are 30 patents granted to members of the Southern Division staff covering machinery and other developments in this field.

2117. THE ROLE OF SPIRAL STRUCTURE IN UNTREATED AND TREATED COTTONS. Orr, R. S.; Burgis, A. W.; DeLuca, L. B.; and Grant, J. N. Textile Research J. 31, 302-10. 1961.

The untwisting of the spiral structure was observed as load was applied to the cotton fiber. Reversals are shown to be a vital structural feature which affects the twisting. A reversing spirality represents an idealized structure for obtaining optimum strength, elongation, and elastic recovery from the straight-chain molecules of cellulose. Friction between growth layers and fibrils in such a structure is suggested as a possible cause for permanent set, low intrinsic strength of highly oriented cotton,

and the weak points near their reversals. The spiral structure persists through mercerization even though tension is applied; however, the X-ray angle is reduced appreciably. The high alignment achieved by resin treatment of cotton while under tension causes a reduction in elongation and increase in strength from that of slack treatment. The high alignment in cotton resin-treated with tension persists through washing with a detergent in water. Differences between properties of cotton are reduced but not eliminated by mercerization and resin treatment.

2124. CONTRIBUTION OF SWELLING TO WATER-RESISTANT COTTON FABRICS:  
EFFECTS OF MATURITY OF COTTON, CLOTH CONSTRUCTION, AND FINISHING  
PROCESSES. Goldthwait, C. F.; and Sloan, W. G. Textile Research  
J. 31, 434-46. 1961

A summary of a comprehensive study of the manufacture and finishing of swelling type water-resistant cotton fabrics of medium weight is presented. Of many fabrics produced, a few were of swelling type in the grey, but only one after finishing. Variables which are usually given lesser consideration, had most attention, viz., maturity, and use of very immature cottons; effects of processing the yarn before weaving; and effects of increasing the tightness of fabrics by adding picks up to 36% more than normal. The fabrics were finished in a pilot plant, and a study was made of the effects of successive steps in finishing on air and water resistance. Fabrics were evaluated by methods intended to exclude water resistance from other sources than swelling. Tests showed that swelling capacity was reduced by finishing, to a greater extent with immature than with mature cottons. This advantage over mature cotton is largely offset, however, because the immature cotton loses 4-5% more noncellulosic material when scoured, which leaves more space to fill by swelling. Cottons of average maturity, and from fine to average in fineness, are preferable. Entrapped air in partially swollen fabrics contributed to water resistance beyond the effect of air in ordinary water-repellent goods. This was observed especially in samples swollen in water vapor and may add to the resistance of a fabric in service if exposed to a very humid atmosphere.

2125. BLENDING COTTONS DIFFERING IN FIBER BUNDLE BREAK ELONGATION. PART II:  
EFFECT ON PROPERTIES OF A COMBED BROADCLOTH. Louis, G. L.;  
Fiori, L. A.; and Sands, J. E. Textile Research J. 31, 478-83.  
1961.

Two control cottons differing in fiber bundle break elongation, but having other pertinent fiber properties essentially equal, were blended in different percentages, spun into warp and filling yarns, woven into a standard combed broadcloth, and then finished commercially. This report discusses the physical properties of these fabrics. Two cottons having significant differences in fiber bundle break elongation at the fiber stage show very little difference in fabric break elongation after finishing, indicating that the influence of fiber elongation gradually



becomes less evident during successive fabric finishing processes. In general, the high elongation fiber cotton produces grey fabric of superior breaking and tearing strengths, elongation, and flex resistance, compared with fabric made from low elongation fiber cotton. Data also indicate that the values of fabric properties of the blended lots cannot be predicted from those of the controls when the fabrics are subjected to various chemical treatments. This report corroborates other findings that no apparent advantage from the standpoint of textile quality, exists in blending low and high elongation fibers--whether in blends of natural-natural or natural-synthetic fibers.

2126. SOME ASPECTS OF THE REACTION BETWEEN UREA AND CELLULOSE.  
Segal, Leon; and Eggerton, F. V. Textile Research J. 31,  
460-71. 1961.

A reaction occurs between cellulose and urea when cellulose and an aqueous solution of urea are heated to an elevated temperature. Evidence for reaction are (1) insolubility of the treated cellulose in cupriethylenediamine, (2) changed infrared absorption spectrum, (3) nitrogen content unaffected by boiling water, (4) changed dyeing properties, and (5) modified moisture regain. There is no change in the cellulose X-ray diffraction pattern, and all of the original cellulose properties are restored by boiling in 2% caustic solution. The urea treatment does not affect the textile properties of cotton fabric. Biuret also reacts with cellulose giving a product having the same properties as the material treated with urea.

2127. A STUDY OF HYPOCHLORITE-RESISTANT MELAMINE-TYPE FINISHES.  
Vail, S. L.; Frick, J. G., Jr.; and Reid, J. D. Am. Dyestuff  
Reptr. 50, 356-60. 1961.

The commercial "wash-and-wear" and wrinkle-resistance finishing agents for cotton fabrics based on melamine-formaldehyde products are widely used but many suffer the disadvantage that the treated fabrics yellow noticeably when washed using hypochlorite bleach. This problem has been studied and the cause of yellowing of fabrics treated with melamine-type agents has been attributed to the reaction of hypochlorite with primary amino groups in the finished fabric. Exclusion of these groups and elimination of the yellowing was accomplished by placing stable substituents, methyl or 2-hydroxyethyl groups, on each amino nitrogen of the s-triazine ring before reaction with formaldehyde. The properties of the fabrics treated with the formaldehyde reaction product of acetoguanamine, N,N-bis(2-hydroxyethyl) melamine, N,N'-dimethyl-N'',N''-bis(2-hydroxyethyl) melamine and N,N',N''-trimethylmelamine are presented and compared with those of fabrics treated with some commercial methylolmelamines and methylated methylolmelamines. The preparation of these melamines and some of their properties are also described.

2128. CHOOSING THE BEST DRAFT. PART III--CARDED LONG STAPLE COTTON. Simpson, Jack; Callegan, A. T.; and Sens, C. L. Textile Inds. 125, (6): 91-96. 1961.

A study was made to determine the allocation of drafts between processes from picking through spinning to obtain yarns of optimum quality, when using long staple cottons. It was found that the long staple cottons were more sensitive to draft allocations prior to spinning than the medium and short staple cottons of previous studies. In general, a light weight (45 grains/yard) card, first and second drawing sliver produced the most uniform roving. A finding of immediate practical value is that comparatively high drafts (20-35) can be employed with the long-draft system when spinning medium and fine yarns (40/1, 60/1 and 70/1--15, 10 and 8 tex.)

2136. CHEMISTRY AND CHEMICAL TECHNOLOGY (Cotton). Knoepfler, N. B. New International Year Book 1960. Funk & Wagnalls, New York, 1960. Also: Condensation anonymously in Universal Standard Encyclopedia Yearbook for 1960, 65. Funk & Wagnalls Unicorn Yearbook Service, New York, 1961. (Reprints not available.)

This paper describes recent advances in cotton technology including a brief resume of wash-and-wear, polyethylene, oil and water repellency, rot and mildew resistance, flame retardants, phosphonomethylation, and other chemical treatments.

2140. EFFECTS OF TENSION DURING RESIN TREATMENT ON PHYSICAL PROPERTIES OF COTTON FIBERS AND YARNS. Orr, R. S.; Burgis, A. W.; and Grant, J. N. Textile Research J. 31, 550-57. 1961.

The effects of tension during resin treatment on the physical properties of yarns and fibers from the yarns were investigated on several cotton samples. The resins applied were of the melamine-formaldehyde and dimethylolethyleneurea types. The strength loss from slack treatments was the result of cross-linking of the internal fiber elements in unfavorable positions for stress equalization. Acid degradation was a factor in certain treatments. Low tensions during treatment were sufficient to prevent much of the strength loss. As elongation was reduced by tension, the energy to rupture was not greatly changed. The selection of high strength, high elongation cottons, and premercerization increased the toughness. Tension before and during drying, followed by low tension during the cure, minimized the losses of toughness in yarns.

2141. FORMAMIDE-FORMALDEHYDE PRODUCTS AS WRINKLE-RESISTANCE FINISHING AGENTS FOR COTTON FABRICS. Vail, S. L.; Frick, J. G., Jr.; Murphy, P. J., Jr.; and Reid, J. D. Am. Dyestuff Repr. 50, 437-40, 464. 1961.

Formamide-formaldehyde finishes have been used previously to some extent to impart wrinkle and shrinkage resistance, and to increase the wet strength of regenerated cellulosic fabrics. Little has been published, however, concerning the properties of cotton treated with such finishing agents. The properties of cotton fabrics treated with these agents are described and it is concluded that the finish produces "wash-and-wear"



fabrics, but the finished fabrics are susceptible to damage from hypochlorite bleaching. For a methylolamide type of finish, it shows a very high resistance to both acidic and basic hydrolysis. The mechanism of wrinkle resistance is believed to be due to crosslinks of both formaldehyde and formamide-formaldehyde types. Crosslinks produced by two methylol groups attached to the same amido nitrogen atom are unusual.

2143. INVESTIGATION ON THE EFFECT OF PREPARATORY FINISHING PROCESSES AND RESIN TREATMENT ON THE TEAR STRENGTH OF VARIOUS COMMERCIAL COTTON FABRICS. Stavrakas, E. J.; and Platt, M. M. U. S. Dept. Agr. ARS 72-18, 22 pp. 1961.

Analytical determinations of the causes of losses in tear strength exhibited by four types of commercial cotton fabrics following resin treatment showed the following: large losses in tearing strength result from the preparatory finishing processes, that is, desizing, scouring, bleaching, and dyeing; scouring was largely responsible for this loss in tearing strength; commercially resinated fabrics exhibit both losses and improvements in tearing strength; the fabric structural types exhibiting significant reductions in tearing strength also had large losses in yarn strength and slight changes in the number of threads rupturing per peak; but that the structural types exhibiting higher tearing strength displayed significant increases in the number of threads rupturing per peak (an indication of improved yarn mobility) and considerably less reduction in yarn tensile strength.

2144. INVESTIGATIONS ON THE MODIFICATIONS OF YARN AND FABRIC STRUCTURE NEEDED TO IMPROVE TEAR STRENGTH OF COTTON FABRICS. Stavrakas, E. J.; and Platt, M. M. U. S. Dept. Agr. ARS 72-19, 16 pp. 1961.

Theoretical and empirical analyses indicate that the tearing strength of cotton fabrics may be improved through structural changes which increase the mobility of the yarns in the plane of the fabrics, by increasing yarn strength, or by combinations of these factors, and that improvements in tearing strength may be obtained through one or more of the following: use of weaves with longer floats, use of more open-textured fabrics, use of opposite twists in warp and filling yarns, and use of coarser, stronger yarns. It, also, was found that the crimp interchange occasioned by a fillingwise stretching action, namely, the increase in warp crimp with a concomitant decrease in filling crimp, will enhance the resistance of the fabrics to tearing.

2145. ALKOXY- AND ARYLOXY-PHOSPHAZENES ("PHOSPHONITRILIC ALKOXIDES AND ARYLOXIDES"). Fitzsimmons, B. W.; and Shaw, R. A. Chem. & Ind. (London) 1961, 109.

Treatment of  $\text{PNC1}_2$  trimer and tetramer with sodium alcoholate or alcohol in the presence of pyridine is an effective method for the

full replacement of the total amount of chlorine in these compounds. The pyridine method being the better of the two except in the case where the alcohol used was methanol. Esters formed from phenol have high thermal stability.

2146. TECHNOLOGICAL TRENDS IN TEXTILES AND CLOTHING. Hoffpauir, C. L. "The Widening Circle; A Report on the Rural Woman's Symposium, Mississippi State University, August 2-4, 1960." Miss. State Univ., State College [1961] pp. 76-80. (Reprints not available.)

A brief review of research achievements in the cotton and wool area are given, and opportunities for future research listed. Timely references of particular interest to home economists are appended.

2148. CHANGES IN FINE STRUCTURE AND MECHANICAL PROPERTIES INDUCED BY CYANOETHYLATION OF COTTON YARNS. II. REACTED WITHOUT LONGITUDINAL SHRINKAGE. Conrad, C. M.; Stanonis, D. J.; Creely, J. J.; and Harbrink, Pieter. J. Appl. Polymer Sci. 5, 163-70. 1961.

The cellulose of cotton yarns was reacted with acrylonitrile under conditions permitting their longitudinal contraction. The changes taking place in the fine structure of the fiber were studied by means of optical microscopy, density measurements, x-ray diffraction, and thermal stress behavior measurements. The results indicate that in spite of the strong tensions developed in the yarns, the reaction proceeds in both the accessible and crystalline regions with considerable volume expansion and eventual disappearance of crystalline structure. Suggestions of a glass transition temperature appear at substitutions slightly above D.S. = 1. Annealing becomes possible at substitutions above D.S. = 2 with the development of the cyanoethyl cellulose crystal structure and over 40% increase in tensile strength. Changes in tenacity, ultimate elongation, energy of rupture, and immediate elastic recovery were also observed. Although electron micrographs of fibrillated fiber specimens and fiber cross sections were prepared during the course of the present studies an adequate discussion of them would carry us too far afield. They will, therefore, be the subject of a separate report.

2149. STUDIES OF THE ETHYLENEDIAMINE-CELLULOSE COMPLEX. III. SOME FACTORS IN THE FORMATION OF THE COMPLEX. Segal, Leon; and Creely, J. J. J. Polymer Sci. 50, 451-65. 1961.

Complete conversion of the cellulose crystal lattice to that of the ethylenediamine-cellulose complex can be attained with ethylenediamine solutions of 60% and greater. Cellulose in the form of loose cotton yarn immersed in 98% ethylenediamine solution for as little as 1 min. is as completely complexed as that immersed 4 hrs., while the same is true for woven fabric. Removal of ethylenediamine in excess to that required by the diamine-cellulose complex is accomplished as effectively by hexane extraction as by evaporation under reduced pressure. Using



the latter procedure a period of 2 hr. is sufficient to reduce the diamine content to that which has been obtained after longer periods, i.e., about 20%. The x-ray diffractograms of the complexes prepared from celluloses I, II, and III suggest that the starting material influences the interplanar spacings of the crystal lattice of the complex. They also show that on water extraction of the complex prepared from cellulose II, the cellulose II lattice is restored, while cellulose I is obtained when cellulose III is used. The infrared absorption spectra of the complexes prepared from celluloses II and III are similar and show slight differences from that of the cellulose I complex. After water extraction of the diamine, the spectrum of the material from the cellulose III complex closely resembles that of the cellulose I material.

PATENTS

2151. CHEMICALLY MODIFIED TEXTILES. U. S. Pat. No. 2,971,815, February 14, 1961. Bullock, A. L.; and Guthrie, J. D.

A process for producing the partial ethers of and the partial esters of cellulose. This process is characterized by the ability to achieve a high degree of chemical modification with the retention of desirable fabric properties. The process involves crosslinking of the cellulose with a polyfunctional reagent prior to or concurrent with the chemical modification.

2153. SCRUBBING MACHINE FOR ON-LOCATION CLEANING OF PILE-TYPE FLOOR COVERING. U. S. Pat. No. 2,972,769, February 28, 1961. Keating, E. J.; Cooper, A. S., Jr.; and Walker, A. M.

An apparatus designed for the "on location" cleaning of pile type floor coverings. The apparatus provides a suds receiver for spent suds, the suds receiver featuring a suds breaking barrier and means for lint removal.

2154. MERCERIZING COMPOSITIONS CONTAINING PIONIC ACID. U. S. Pat. No. 2,974,002, March 7, 1961. Hedrick, G. W.

A composition of matter useful for mercerizing cotton. The composition, among other components, contains pinonic acid.

2155. METALLIC SELENIDE FUNGICIDES FOR OUTDOOR CELLULOSIC TEXTILES. U. S. Pat. No. 2,977,250, March 28, 1961. Brysson, R. J.; and Reeves, W. A.

A process for the treatment of cellulosic textile materials with selenides so that the cellulosic textile material exposed to direct or indirect sunlight is rendered resistant to attack and staining by microorganisms.

2156. FIBROUS TEXTILE CELLULOSIC PHOSPHONOMETHYL ETHERS AND PROCESS OF PREPARATION. U. S. Pat. No. 2,979,374, April 11, 1961. Drake, G. L., Jr.; Reeves, W. A.; and Guthrie, J. D.

A process for preparing the phosphonomethyl ethers of cellulose in fibrous form; the salts of these ethers; soluble phosphonomethyl ethers of cellulose. A process for reducing the combustibility of fibrous cellulosic materials and a process of producing fibrous cellulose with high cation capacity.



2157. TEXTILE FIBERS COMPRISING PERFLUOROALKANOYL ETHERS OF CELLULOSE AND PROCESS OF MAKING THE SAME. U. S. Pat. No. 2,980,491, April 18, 1961. Segal, Leon; Loeb, Leopold; Takamura, K. H.; and Phillips, F. J.

A process for preparing perfluoroalkanoic esters of cellulose and the product of this process. The cellulosic esters that are the subject of this invention exhibit properties such as resistance to wetting by liquids of all kinds, increased elasticity, and increased resistance to burning.

2158. LICKERIN AND FEED ROLL COVER. U. S. Pat. No. 2,983,966, May 16, 1961. Brown, R. S.; and Miller, A. L.

An improved type of lickerin cover which also covers the feed roll of a conventional carding apparatus and improves the cleaning action of the lickerin and reduces the loss of spinnable fiber.

2160. PRODUCTION OF STRONG, ROT RESISTANT BENZYL CELLULOSE FIBERS. U. S. Pat. No. 2,990,234, June 27, 1961. Klein, Elias; Stanonis, D. J.; and Harbrink, Pieter.

A process for the production of strong, rot resistant benzyl cellulose fibers. The process described affords fibrous cellulose, benzylated to a high degree of substitution but with undiminished tensile strength.

2161. SRRL REPORTS! Rusca, R. A. Textile Inds. 125, (7): 77-80, 82. 1961.

The Southern Regional Research Laboratory was established in 1938 as an agency of the U. S. Department of Agriculture for the purpose of conducting research to increase the utilization of agricultural commodities grown in the southern part of the United States. The laboratory building was completed in 1941, and staffed soon thereafter. Most of the work is concerned with lint cotton, starting with the baled fiber and stopping with the finished fabric. Research is conducted on chemical and physical treatments of fibers, yarns, and fabrics, and on the development of new and improved textile processing methods and machinery. An essential part of the program to increase the use of cotton is the development of new textile processing equipment to raise the quality and lower the cost of cotton textiles. A 15- to 20-man team of engineers, physicists, fiber technologists, and technicians is assigned to this type research. This paper briefly reviews the Laboratory's machinery and apparatus developments for the period of July 1, 1950 to June 30, 1960.

2162. A REPORT: THE JOINT CONFERENCE ON CANVAS AWNING RESEARCH. Brysson, R. J.; Reeves, W. A.; and Persell, R. M. Canvas Prods. Rev. 37, (3): 35, 49, 59. 1961.

The three-party cooperative research program among the Canvas Products Association International, the Southern Utilization Research and Development Division (USDA), and the Foundation for Cotton Research and Education (an affiliate of the National Cotton Council) is described and the first joint meeting of the Canvas Products Advisory Committee and the Technical Advisory Group for Canvas Goods is reported. A summary of recommendations by the Committee for future research on outdoor fabrics is included.

2163. SLIVER DIRECTION, HOOKED ENDS HAVE SIGNIFICANT EFFECT ON THE PARALLELIZATION OF COTTON FIBERS. Simpson, Jack. Textile Bull. 87, (7): 39-42. 1961.

The Lindsley mechanical method for measuring fiber parallelization was compared with a method similar to Morton's, using tracer fibers. It was found that sliver direction has a highly significant effect on the parallelization measurement with the Lindsley instrument. The tracer fibers showed that this is due to the predominance of hooked ends in one direction. This indicates that the Lindsley instrument could be used to measure the predominance of hooked ends in a given direction. It was indicated that a high draft tends to straighten out more of the trailing than the leading hooks. The tracer fibers showed that drafting tends to straighten and align the longer fibers better than the shorter ones of a particular cotton.



2168. THE CELLULOSE-BUTADIENE DIEPOXIDE REACTION AND ITS EFFECT ON THE CREASE RESISTANCE OF COTTON. McKelvey, J. B.; Benerito, R. R.; Webre, B. G.; and Berni, R. J. J. Polymer Sci. 51, 209-30. 1961.

Butadiene diepoxide (BDE), the meso-1,2,3,4-diepoxybutane, may be added to cotton cellulose with a variety of catalysts and conditions at room temperature. Slow addition of BDE from nonpolar solvents to yarns pretreated with alkali resulted in weight gains which were proportional to the activity of hydroxyl ions used in pretreatment. For a given hydroxyl ion activity, percentage weight gains of BDE varied directly with time of reaction. Add-on of BDE is proportional to the product of hydrolyzed BDE and molarity of the hydroxyl ion in the dilute alkali. Slow addition of epoxide from carbon tetrachloride solution to cotton fabric impregnated with dilute alkali, neutral salts, or alkaline salt solutions produces a fabric of good dry and wet crease recovery. Rapid addition of epoxide to fabric by the use of more concentrated alkali or elevated temperature produced excellent wet, but no dry, crease recovery. Hydrogen ion catalysis of the BDE-cotton reaction is very slow and, in the case of acetic acid, is without effect. With sulfuric acid, only mediocre wet crease recovery is produced at room temperature. Catalysis with zinc fluoborate, methanolic solutions of BDE, and curing temperatures of 75-125° resulted in excellent wet and dry crease resistance at weight gains of less than 2%. Methods that produce good dry crease recovery cause a lowering of tearing and breaking strengths. Little change in tensile properties occurs when only wet crease resistance is imparted. This suggests that profound physical changes in the fine structure of cellulose result from mild chemical action with a water-soluble diepoxide. Crease recovery of cotton fibers in the wet and dry states has been attributed to intermolecular covalent crosslinking of anhydroglucose unit hydroxyls by the diepoxide with a resultant diminution of inter-chain slippage. Fibers that exhibit only wet crease recovery are believed to have a minimum of covalent crosslinks and to be hydroxy cellulose monoethers of the epoxide or graft polymers of the same, which prevent slippage of chains only when wet and swollen (possibly by entanglement).

2170. COTTON MADE RESISTANT TO MICROBIOLOGICAL DETERIORATION USING FORMIC ACID COLLOID OF METHYLOMELAMINE. Berard, W. N.; Leonard, E. K.; and Reeves, W. A. Developments in Ind. Microbiol. 2: 79-91. 1961.

Cotton fabric has been made rot- and weather-resistant by treatment with a freshly prepared formic acid colloid of methylolmelamine. Previous investigations have shown that acid colloids allowed to age at least 12 hr. and as long as 24 hr. do not impart much resistance to microbiological deterioration. The method of application of the freshly prepared acid colloid is essentially the same as conventional procedures used for resin finishing, that is, pad, dry, and cure. The main difference is the use of formic acid in the treating solution to produce a colloid. Cotton fabric finished with the acid colloid of methylolmelamine at about 12% resin add-on had excellent resistance to



microorganisms compared to cloth finished with methylolmelamine in the conventional manner at the same level of resin add-on. A curing temperature of at least  $140^{\circ}\text{C}$  is required. In microscopic studies of cotton fibers treated with the formic acid colloid of methylolmelamine the resin was deposited primarily in the outer portion of the cell wall, which did not swell in the reagent; the innermost section of the fiber responded to cupriethylenediamine hydroxide by inhomogeneous solution in a manner similar to that observed for cotton having small amounts of bound formaldehyde.

2172. THERMAL NEUTRON IRRADIATION OF COTTON. Blouin, F. A.; Arthur, J. C., Jr.; Orr, R. S.; and Ott, V. J. Textile Research J. 31: 597-602. 1961.

Purified cotton samples were irradiated in a "pure" source of thermal neutrons in the dosage range of  $5 \times 10^{14}$  through  $1 \times 10^{17}$  neutrons per  $\text{cm}^2$ . Neutron irradiation produced chain cleavage, carboxyl groups, and reducing groups in the cotton cellulose. The water solubility of the cotton was not appreciably affected in this dosage range. Wet and dry strengths and elongation of the cotton were decreased by neutron irradiation. The uniformity of strength along the fiber length was only slightly lowered. The reducing groups produced in the neutron-irradiated cotton were shown to be markedly different in degree of reaction with sodium chlorite, copper equivalence, and influence on alkali sensitivity from the reducing aldehyde groups produced by periodate oxidation of cotton cellulose. A close similarity between the effects of thermal neutron and gamma ray irradiation on cotton was observed.

2173. SOFTNESS OF COTTON YARNS AS AFFECTED BY FIBER AND YARN PROPERTIES. Honold, Edith; and Grant, J. N. Textile Research J. 31, 643-50. 1961.

Yarn softness is evaluated quantitatively as the percent increase in yarn width under a definite lateral force. Single-yarn softness decreases with twist and increases with yarn number and fiber maturity. With the above parameters constant, softness has no relation to fiber linear density. An equation is developed for estimating single-yarn softness from yarn diameter and twist and from fiber maturity. The softness of 2-ply yarns as related to the component single yarns is discussed. For modified cottons, increased fiber friction apparently contributes to the decrease in yarn softness. An equation is developed to estimate the single-yarn diameter from yarn number and twist multiplier. The possibility that the diameter of the 2-ply yarn is related mathematically to the ply yarn twist multiplier and to the softness of the original unplied single yarn is discussed.



2177. BETTER WAY TO MAKE COTTONS WATER REPELLENT. Koltun, S. P.; Decossas, K. M.; Conner, C. J.; Reeves, W. A.; and Pollard, E. F. Textile Inds. 125, (8): 119, 144-45, 187. 1961.

This preliminary cost study shows that it would cost as little as 3.8 cents per yard to treat cotton with silicone alloy, or 5.7 cents per yard to impart the additional property of crease resistance with silicone alloy-triazone at the continuous rate of 120 yards per minute. This treatment, which imparts excellent water repellency and crease resistance to cotton, should enable cotton to further its expansion in the rainwear market and enter into the industrial field in areas where the properties of water repellency and crease resistance are desirable. After soap-soda boiling, the spray ratings of the treated fabrics show very little drop, nor is the fabric hardened or discolored. Other advantages are low curing time and temperature.

2178. DIHYDROXYETHYLENEUREAS AS WRINKLE-RESISTANCE FINISHING AGENTS FOR COTTON. Vail, S. L.; Murphy, P. J., Jr.; Frick, J. G., Jr.; and Reid, J. D. Am. Dyestuff Reprtr. 50: 550-53. 1961.

The ring hydroxyl groups of 4, 5-dihydroxy-2-imidazolidinones (dihydroxyethyleneureas) have been shown to be chemically active and to produce crosslinks similar to those produced by conventional N-methylol crosslinking agents. The properties of fabrics treated with some dihydroxyethyleneureas have been studied and compared with fabrics treated with dimethylolethyleneurea. 1,3-Dimethyl-4,5-dihydroxy-2-imidazolidinone, believed to be a new compound, has been prepared and found to produce wrinkle-resistant cotton fabrics. These fabrics were highly resistant to chlorine damage and had good resistance to acid souring. Wrinkle-resistant fabrics were also produced from 4,5-dihydroxy-2-imidazolidinone. These fabrics, however, were yellowed during curing and were highly susceptible to chlorine damage.

2179. EFFECT OF SHORT FIBERS IN COTTON ON YARN, FABRIC PROPERTIES AND SPINNING PERFORMANCE (S.R.R.L. Data Shows an Upper Limit of  $3/8$  Inch Limit Now Used). Tallant, J. D.; Fiori, L. A.; and Cheatham, R. J. Textile Bull. 87, (8) 51, 54-57, 70-71. 1961.

Experimental data are presented showing that an upper limit of  $3/8$  inch is more valid than the  $1/2$  inch limit now commonly used for evaluating the effect of short fibers on spinning performance. An accurate means of converting from one measure to the other is presented. Differential ginning is described and some of the pertinent fiber properties obtainable by this technique are given. A significant change in Micronaire reading as well as short fiber content occurs with successive stages of differential ginning. Twist-strength curves of yarns spun from cottons differing in short fiber content show that as

short fibers increase yarn tenacity decreases but the twist for maximum strength is not affected as long as staple length remains substantially constant. Yarn appearance is seriously degraded as the short fiber content increases. Perhaps the most serious effect of increases in the short fiber content is their effect on spinning efficiency. Excessive amounts of short fibers seriously reduce the speed at which a given yarn can be spun with an acceptable ends-down rate. The deleterious effects of short fibers are shown to affect the physical properties and appearance of the greige bleached, dyed and resin-treated cotton fabrics.

2180. PERCENTAGE OF SHORT FIBERS A VALUABLE TOOL IN EVALUATING COTTON FOR SPINNING PERFORMANCE (S.R.R.L. Study Offers "Percent Effect Weight" As A New Analytical Tool for Fiber Evaluation). Tallant, J. D.; Fiori, L. A.; and Castillon, A. V. Textile Bull. 87, (8): 38-40. 1961. Also: "Where We Stand in Measuring Length and Strength", Cotton Gin and Oil Mill Press 62, (11): 30-32. 1961; Proc. Cotton Marketing Conf. Research Clinic, Memphis, Tenn., May 16-17, 1961, 8-9.

While the classer and instruments give an excellent measure of the longer fibers in the length distribution of cotton, increased demands by the industry require the measurement of at least one additional parameter of length distribution. A new concept termed "Percent Effective Weight" is introduced as an analytical tool and seems to indicate that about 3/8-inch is the critical length below which fibers are incapable of being twisted into a yarn structure sufficiently to rupture and contribute to yarn strength. Various types of strength tests are discussed. The major proportion of time is consumed in the present tests by loading the jaws and shearing the outside fibers. It is suggested that efforts at automation should concentrate on this phase. Two suggested procedures for measuring length distribution characteristics are described. One procedure utilizes the conventional strength testers, but uses a modified procedure of specimen preparation which allows the short fibers to remain in the specimen. The other procedure, on which no experimental work has been done, suggests an optical principle which requires no specimen preparation.

2181. SHORT CUT TO BETTER BLENDING FOR COTTON. Louis, G. L.; Fiori, L. A.; Lewis, H. G.; and Mayne, S. C., Jr. Textile World 111, (8): 70-71. 1961.

To facilitate determinations of the fiber fineness of cotton blends, three nomographs are presented, based on blending cotton by weight (actual weight or percent). Nomograph No. 1 deals with blend composed of two cotton fiber fineness components. Nomograph No. 2 is an extension of Nomograph No. 1 and provides for determination of resultant fiber finenesses of blends composed by allowing use of more than two cotton fiber fineness components. Nomograph No. 3 is an auxiliary to Nos. 1 and 2 for determining the resultant fiber fineness of blends composed of specified weight or bales of three or more different fiber finenesses.



Copies of these nomographs are available on request from the Southern Regional Research Laboratory, 1100 Robert E. Lee Boulevard, New Orleans, Louisiana.

2184. A QUICK METHOD FOR DETERMINING THE ELONGATION, THE BREAKING AND TEARING STRENGTHS OF PLAIN WOVEN FABRICS. Louis, G. L.; and Fiori, L. A. Textile Research J. 31: 754-56. 1961.

An abbreviated method for quickly determining fabric breaking strength, elongation and fabric tearing strength is suggested. The method deviates from the conventional procedure, and it involves composite testing of fabric samples in the warpwise and fillingwise directions simultaneously. This exploratory investigation with plain woven fabrics showed that the composite testing method is much quicker than conventional methods and gives substantially similar values.

2187. WRINKLE- AND MUSS-RESISTANT FINISH FOR COTTON USING FORMIC ACID COLLOID OF METHYLOLMELAMINE. Berard, W. N.; Leonard, E. K.; and Reeves, W. A. Am. Dyestuff Reprtr. 50: 627-30, 634. 1961.

Cotton fabric has been made wrinkle-resistant by treatment with a freshly-prepared formic acid colloid of methylolmelamine. Conditions of treatment to impart wrinkle resistance are similar to those which produce resistance to microbiological deterioration. Print cloth finished with the acid colloid of methylolmelamine at about 7% resin add-on has good wrinkle- and muss-resistance. Properties of finished fabrics compare favorably with those of fabrics finished by a conventional process. Properties compared include breaking strength, tear strength, wrinkle recovery, chlorine damage, and nitrogen retention, after 5, 10, and 20 wash and tumble-drying cycles. Although acid colloid-finished print cloth yellows less when treated with strong sodium hypochlorite solutions than does conventional trimethylolmelamine-finished cotton, the finish is not recommended for white goods. Microscopical studies were made on fibers treated with the formic acid colloid of methylolmelamine by examination of cross sections stained with Cl Acid Blue 1 and by treating ultra-thin sections with cupriethylenediamine hydroxide. The resin was deposited primarily in the outer portion of the cell wall of the cotton fiber, and the innermost section of the fiber responded to cupriethylenediamine hydroxide in a manner similar to that observed for cotton having small amounts of crosslinked cellulose.

2188. FORMIC ACID COLLOID OF METHYLOLMELAMINE RESIN FINISH OF COTTON FOR WRINKLE- AND MUSS-RESISTANCE: PRELIMINARY COST STUDY. Decossas, K. M.; McMillan, O. J., Jr.; Berard, W. N.; Reeves, W. A.; Pollard, E. F.; and Patton, E. L. Am. Dyestuff Reprtr. 50: 631-33. 1961.

Investment and operating costs for a hypothetical plant are reported for the application of the formic acid colloid of methylolmelamine resin finish to cotton to impart wrinkle- and muss-resistance. The

cost study is based on finishing 80x80 cotton print cloth, 50 inches wide, 3.12 linear yards per pound, to a seven percent resin add-on, by continuous operations in a hypothetical plant, at a processing rate of 120 yards per minute. It is estimated that processing cost ranges from 3.7 cents per linear yard at an annual production of 60.5 million yards to 5.1 cents per linear yard at an annual production of 14.4 million yards. Alternatively expressed, the costs range from 2.7 to 3.7 cents per square yard, or from 10.8 to 14.8 cents per pound of product. These costs are exclusive of the cost of cotton used and are for custom processing without profit. This inexpensive finish can be applied by continuous processing in conventional textile equipment. The importance of wrinkle resistance as a consumer quality requirement is also reported.

2189. WHAT HAPPENS TO PRODUCT QUALITY WHEN COTTON BLENDS VARY IN THEIR FLAT BUNDLE STRENGTHS? (S.R.R.L. Investigators Have Found That A Number of Factors Are Related to Fiber Bundle Strength). Sands, J. E.; Flori, L. A.; and Louis, G. L. Textile Bull. 87, (9): 45-50. 1961.

One bale of a relatively strong and one of a relatively weak cotton were individually blended to insure homogeneity, within the bale, then divided to supply proper quantities for the processing of 150 pounds of stock of each of the cottons and of each of three blends (25/75, 50/50 and 75/25). The five 150-pound lots were processed into warp (30/1, 20 tex) and filling (40/1, 15 tex) yarns for weaving 80x80 print cloth. However, only the two control cottons and the 50/50 blend were processed into fabrics. These were chemically finished in commercial operations through singeing, desizing, scouring, bleaching, mercerizing and dyeing. A resin (wash-and-wear) formulation was subsequently applied at S.R.R.L. Fiber bundle strength was found to be related to (1) the proportion of weak and strong fiber cottons in the blend; (2) the strength of yarns spun from them; (3) warp strip breaking strength in the grey; scoured; bleached; bleached, mercerized and dyed; and bleached, mercerized, dyed and resin-treated states; (4) filling strip breaking strength in all but the bleached, mercerized, dyed and resin-treated states. The results of grab tests indicated somewhat similar trends, while flex abrasion was apparently not affected by cotton fiber bundle strength. The higher level of properties of the fabric produced from the strongest-fibered cotton after resin treatment was, in each case, percentage-wise (14%), about equal to the higher level of fiber bundle strength exhibited by the strongest-fibered cotton.



2193. INFRARED SPECTRA OF ALIPHATIC NORMAL MONO-AMINES AND ALPHA-OMEGA DIAMINES. Segal, Leon; and Eggerton, F. V. Appl. Spectroscopy 15: 112-16. 1961.

Solution spectra of aliphatic normal primary mono-amines from ethyl to decyl and of alpha-omega diamines from ethylene to octamethylene are presented, as well as KBr spectra of the diamines. Assignments are made of various bands to structural moieties in the molecule. The solution spectra in each homologous series are markedly similar, but the KBr spectra of the diamines show differences distinct enough for qualitative identification.

2194. INFRARED SPECTRA OF ETHYLENEDIAMINE AND THE DIMETHYLETHYLENEDIAMINES. Segal, Leon; and Eggerton, F. V. Appl. Spectroscopy 15: 116-17. 1961.

Infrared spectra of ethylenediamine, N,N-dimethylethylenediamine, and N,N'-dimethylethylenediamine are presented. Correlation of the absorption bands with molecular structure is attempted. The principal differences to be expected in the spectra would arise from the effects of the methyl groups on C-N stretching and on -NH<sub>2</sub> vibrations.

2196. RESEARCH OPENS NEW FIELDS FOR COTTON. (No reprints available). Fisher, C. H. Daily News Record No. 57, Sec. 2, 22 (March 23, 1961).

A brief, popular article indicating the role research plays in helping cotton maintain its position in the highly competitive textile fiber market. Highlighted are chemical modification to impart special properties, including wash-wear characteristics, new processing techniques that result in quality improvements, and the development of new and improved machinery designed to clean lint cotton more completely and efficiently.

2203. A STUDY OF REACTIONS BETWEEN COTTON CELLULOSE AND DIFUNCTIONAL EPOXIDES. Benerito, R. R.; Webre, B. G.; and McKelvey, J. B. Textile Research J. 31: 757-69. 1961.

Four diepoxides, namely, the diglycidyl ether of 1,4-butanediol, meso-butadiene diepoxide, Eponite 100, and vinylcyclohexene dioxide have been applied to cotton print cloth (80x80) from methanolic and aqueous solutions in the presence of zinc fluoborate as catalyst. Physical properties imparted to cotton by these diepoxides under various conditions of reaction and cure have been evaluated. Data are presented to show variation of fabric properties with mole ratios of diepoxide: Zn(BF<sub>4</sub>)<sub>2</sub>: AGU (anhydroglucose units of cotton cellulose). It has been found for all except butadiene diepoxide that a given add-on does not result in like fabric properties and that for a certain percentage improvement in dry crease resistance, a higher retention in tensile properties is obtained at the higher AGU: Zn(BF<sub>4</sub>)<sub>2</sub> mole ratio.

2204. MODULI OF COTTON FIBERS AND YARNS IN RELATION TO X-RAY ANGLES. Weiss, L. C.; Orr, R. S.; Redmann, J. J.; and Grant, J. N. Textile Research J. 31: 787-93. 1961.

Cotton samples with a wide range of variation in fiber properties were chosen. An X-ray measure of the degree of crystallite orientation and/or the secant modulus of fifteen cottons are traced through levels from sub-fibers to single fibers to bundles to yarns. The differences due to sample characteristics gradually become less as the cottons progress through these levels. When the secant modulus of the yarns spun at the appropriate twist for maximum strength is referred to the X-ray measurement, no additional masking, but resolution occurs. The resolution seems to be more pronounced with American upland than with barbadense cottons. Tenacity, secant modulus, and bundle linear density primarily explain the rankings.

2205. WRINKLE RESISTANT PROPERTIES OF DIALDEHYDE COTTON. Mack, C. H.; and Reeves, W. A. Textile Research J. 31: 800-03. 1961.

The effect of periodic acid oxidation on the wrinkle resistance of cotton fabric has been investigated. In the range of oxidation where basic fabric properties are preserved the dry wrinkle recovery angle increases with increasing oxidation. The change in wet wrinkle recovery angle for these fabrics is negligible, suggesting that cross-links which are evident in the dry state are broken in the presence of water. An explanation involving hemiacetal and hemialdal formation is advanced.

2206. RADIATION-INDUCED INTERACTION OF ACRYLONITRILE WITH CYANOETHYLATED COTTON. Demint, R. J.; Arthur, J. C., Jr.; and McSherry, W. F. Textile Research J. 31: 821-24. 1961.

The radiation-induced interaction of acrylonitrile with cyanoethylated cotton probably involves grafting of side chains of acrylonitrile at the site of the cyanoethyl groups. The extent of interaction is dependent on the degree of substitution of the cotton and on radiation dosage. There are increases in delayed elastic recovery and elongation-at-break and decreases in permanent set, average stiffness, and solubility of the cellulose of the treated cottons.

2207. DERIVATIVES OF UNSATURATED PHOSPHONIC ACIDS. Welch, C. M.; Gonzales, E. J.; and Guthrie, J. D. J. Org. Chem. 26: 3270-73. 1961.

Salts of vinylphosphonic acid and derivatives of the type  $\text{CH}_2\text{-CHP(O)(X)OCH}_2\text{CH}_2\text{Cl}$  where  $\text{X-Cl}$ ,  $\text{N(CH}_3)_2$  and  $\text{OCH}_3$  have been prepared starting from the commercially available bis(2-chloroethyl) vinylphosphonate. Diethyl 1(and2)-propynylphosphonate has been prepared



from propargyl bromide and diethyl phosphonate. The molar refractions and infrared absorption spectra of several of these materials have been determined, and the significance of the spectra is discussed.

2208. NEW METHODS FOR THE PREPARATION OF ALKALI-SOLUBLE TEXTILE MATERIALS. Reinhardt, R. M.; Fenner, T. W.; and Reid, J. D. Am. Dyestuff Reprtr. 50: 694-701. 1961.

New methods for the preparation of alkali-soluble textiles have been developed at the Southern Regional Research Laboratory, with cotton as a starting material. Etherification of cotton to a low degree of substitution followed by treatment of the partially etherified cotton with many cellulose oxidizing and/or hydrolyzing agents yields modified cottons which are soluble in aqueous alkali. The value of the partial etherification step in the preparation is emphasized in the comparatively mild conditions operative in the oxidation-hydrolysis step. These conditions produce fibrous materials with better strength-solubility characteristics than the more rigorous conditions necessary in the treatment of native cotton, and are more economical. The availability of more satisfactory soluble products and methods for their production may encourage greater utilization of these unique cellulose derivatives. Partially etherified cottons which have been used in this study include aminoethylated, carbomoyl ethylated, carboxyethylated, cyanoethylated, hydroxyethylated, methylated, alpha-methylcarboxymethylated, and phosphonomethylated cotton. For the oxidation-hydrolysis step, chromic acid, chromic acid-oxalic acid mixture, periodic acid, nitrogen dioxide, sodium nitrite-mineral acid mixture, nitric acid, sulfuric acid, hydrochloric acid, sodium hypochlorite, and potassium permanganate treatments have been investigated. A number of these combinations result in fibers which have promising commercial potential---solubility, strength, and simplicity and economy of production.

2210. FAST SPINNING TEST. Louis, G. L. Textile Inds. 125, (11): 76-80, 96. 1961.

An accelerated spinning ends-down technique to evaluate the spinning performance of cotton is under development, based on the theory that too much or too little twist in yarns causes excessive end breakage during spinning. The technique calls for the spinning of yarn sizes selected according to the staple length under higher-than-normal yarn tensions, in a series of low to high twist multipliers while maintaining a constant front roll speed. The relationship between end breakage and twist multipliers can be described by an up-turned parabolic curve. Pertinent information leading to the development of the technique is presented. Limited data indicate that the technique has good sensitivity and reproducibility. This spinning technique indicates the relative level of end breakage and the probable optimum production spinning rate for different cottons, requires only small amounts of cotton, and saves time.

2211. CAN YOU BLEND WHITE AND LIGHT SPOTTED COTTONS WITHOUT IMPAIRING YARN AND FABRIC PROPERTIES? (S.R.R.L. Researchers Find You Can Provided Blending Techniques Are Properly Controlled). Fiori, L. A.; Sloan, W. G.; and Marsh, P. B. Textile Bull. 87, (10): 45-46, 48-52. 1961.

Four selected light spotted cottons were blended with white control cottons in various percentages and were processed into yarns and finished fabrics. Light spotted cottons of the type used in this investigation apparently can be used successfully in blends up to 25% with white cotton without impairing seriously either yarn or fabric properties in the greige state. For finished materials, there are indications that desizing, a double caustic boil-off, stripping with 10% sodium hydrosulphite and bleaching before dyeing are effective in eliminating color differences due to spotted cottons.

2212. WHEAT NEW CHEMICAL COTTONS WILL COST. (New Products from Cotton: Processes, Equipment, and Costs.) Decossas, K. M.; Koltun, S. P.; and Patton, E. L. Textile Inds. 125, (11): 101, 103, 107, 111, 112, 115. 1961.

Cotton utilization research at the Southern Utilization Research and Development Division is offering industry new and improved cotton products having useful and valuable properties. Equipment costs have been adjusted to the December 1959 level, classified for the various equipment units by material of construction and size, charted, and are presented for quick reference and use. Direct, indirect, and fixed processing costs for a number of finishes, exclusive of chemical costs, have been correlated, generalized, and are charted at processing rates of 10, 50, and 120 yards of fabric per minute. A preliminary cost estimate is developed from the charts for the APO-THPC flame retardant finish for cotton fabric. This illustrative application results in no significant change in estimated equipment, total plant, and processing costs. Using a projected THPC price of 70 cents per pound, and projected prices for APO ranging from 30 cents to \$2.25 per pound, costs for imparting the required degree of flame resistance varied from 10.1 cents to 23.9 cents per yard of fabric at a processing rate of 120 yards per minute and an annual production of 60,480,000 yards of fabric. A sliding scale factor is suggested for open-width cotton chemical processing equipment in place of the six-tenths factor generally used in chemical engineering cost estimation.



2216. EVALUATION OF THE EFFECTS OF FABRIC STRUCTURE AND RESIN TREATMENT ON TEAR STRENGTH AND OTHER PROPERTIES OF COTTON FABRICS. Stavrakas, E. J.; and Platt, M. M. U. S. Dept. Agr. ARS 72-20, 33 pages. 1961. (Processed).

Information developed in the theoretical and empirical analyses of fabrics and structural variations which contribute to tear strength, was used as a guide in production of a series of 31 experimental fabrics, including controls of the four principal types of cotton fabrics (print cloths, broadcloths, twills, and sateens) from a blend of selected bales of Delta Pineland cotton. Fabrics were resin-treated. The analyses of this series of fabrics showed the following: The preparatory treatments generally had a more deleterious effect on tearing strength than did the resin treatment; that the structural variations which gave enhanced yarn mobility or those containing stronger yarns, yielded fabrics with improved tearing strength; and that structural variations which resulted in improved tearing strength did not adversely affect drape, tensile strength, abrasion resistance, and crease recovery.

2217. FLUORESCENT WHITENING AGENTS IN "WASH-WEAR" FINISHING OF COTTON. Reinhardt, R. M.; Fenner, T. W.; Reid, J. D.; Furry, M. S.; and Walsh, Mary. Am. Dyestuff Repr. 50, P771-P778. 1961.

The use of fluorescent whitening agents in the "wash-wear" finishing of cotton fabrics was investigated. Three processing techniques for applying the whitener were used. Applications prior to the cross-linking treatment, after the crosslinking treatment, and with the crosslinking agent in the same pad bath were studied. Eight fluorescent whitening agents and two crosslinking agents were included in the work. Color measurements indicating the whitening effects produced in the fabric by the different finishing treatments were made with ultraviolet radiation either included or excluded. Durability of these whitening effects to various types of laundering was determined. Any changes in the fabric's resistance to wrinkling and susceptibility to chlorine and light damage due to the treatments also were noted.

2221. THE EFFECT OF THE SHORT FIBERS IN A COTTON ON ITS PROCESSING EFFICIENCY AND PRODUCT QUALITY. PART III: PILOT-SCALE PROCESSING OF YARNS. Tallant, J. D.; Fiori, L. A.; Alberson, D. M.; and Chapman, W. E. Textile Research J. 31: 866-72. 1961.

By differential ginning of a single lot of Acala 44 cotton, various short fiber content levels were obtained. Yarns produced from these cottons showed the effects of increases in short fiber content; namely, reduced strength, elongation, and appearance grade. The twist required for maximum strength was found to be largely unaffected by changes in short fiber content, except for a medium yarn number for which a



relationship was demonstrated. A graph showing the close relationship between the percentage of fibers less than  $3/8$  in. and those less than  $1/2$  in. calculated for a wide number of cottons, is included. Spinning efficiency is shown to be adversely affected by changes in short fiber content.

2222. A STATISTICAL PROCEDURE FOR DETERMINING END BREAKAGE RATE IN SPINNING. Schultz, E. F, Jr.; Little, H. W.; Tallant, J. D.; and Fiori, L. A. Textile Research J. 31: 872-74. 1961.

Standard deviations of yarn break data, taken by uniform increment of spindle hours, increased linearly with average rate of breakage and were larger than expected for a Poisson distribution. Transforming the numbers of breaks to  $\log_{10} (1 + \text{number of breaks})$  stabilized the variance. In a specific case, analysis of data for 720 spindle hours per yarn taken by 12 increments of 60 hours enabled 95% confidence limits describing the average number of breaks per yarn as within 30% of the observed number of breaks.

2223. CROSS-LINKING ETHERIFIED COTTONS WITH DIMETHYLOL ETHYLENEUREA. Kullman, R. M. H.; Frick, J. G., Jr.; Reinhardt, R. M.; and Reid, J. D. Textile Research J. 31, 877-85. 1961.

The effects of crosslinking with dimethylol ethyleneurea on several etherified cotton fabrics--carboxymethylated, hydroxyethylated, methylated, and cyanoethylated cottons--were studied and compared with its effects on unmodified cotton. The effect of replacing cellulosic hydroxyl groups on the reactivity toward dimethylol ethyleneurea is dependent on the nature of the substituent and the swellability of the etherified fiber. Hydroxyethylated and methylated cottons exhibit greater cross-linking efficiency with dimethylol ethyleneurea than does unmodified cotton. High moisture regain in conjunction with high wet and conditioned wrinkle recovery is possible with hydroxyethylated cotton. Increased extensibility observed in etherified cottons is directly related to the alkali concentration used in the etherifying reaction. The rate of strength loss on cross-linking, with unit improvement in crease recovery, is greater for etherified cottons, except hydroxyethylated, than for unmodified cotton.

2225. INFRARED SPECTRA OF DIETHYLENETRIAMINE AND 2-(2-AMINOETHYLAMINO)-ETHANOL. Segal, Leon; and Eggerton, F. V. Appl. Spectroscopy 15: 148-50. 1961.

Infrared spectra of diethylenetriamine and 2-(2-aminoethylamino)-ethanol are presented. The absorption bands are correlated with molecular structure. The principal differences to be expected in the spectra would arise from the presence of the OH group replacing an  $\text{NH}_2$  group. The greatest effect observed, however, is that of enhanced hydrogen bonding.



2226. PREPARATION AND PROPERTIES OF FIBROUS PARTIAL ISOBUTYRATES OF CELLULOSE. St. Mard, H. H.; Hamalainen, Carl; and Cooper, A. S., Jr. Am. Dyestuff Repr. 50: 796-800. 1961.

Cotton cellulose in the form of yarn and fabric has been partially esterified with isobutyric anhydride with retention of the fibrous structure and the excellent textile characteristics of cotton. The process involves activating the cotton, removal of the activating agent, and heating with the anhydride in a diluent containing potassium isobutyrate as the catalyst. The products have excellent strength retention, have rot and heat resistance essentially equal to that of partially acetylated (PA) cotton, and show no appreciable loss in tear and abrasion resistance. However, they have poor resistance to outdoor weathering, which seems to be common to most fibrous esterified cottons.

2228. USING LONG STAPLE COTTON HIGH-ELONGATION FIBER WILL BOOST SPINNING OUTPUT. (Effect of Fiber Elongation and Spinning Tension on Yarn Break Elongation and Strength.) Louis, G. L.; Fiori, L. A.; and Sands, J. E. Textile Inds. 125, (12): 97, 99, 101, 104. 1961.

Long-staple cottons differing appreciably in fiber bundle break elongation, but with other pertinent fiber properties about equal, were spun into a 60/1 yarn at three levels of ring sizes, traveler weights, and traveler speeds, all of which were evaluated in terms of spinning tension. Increasing spinning tension directly and significantly affected yarn break elongation, which decreased at about the same rate, regardless of differences in fiber elongation. Yarn uniformity was affected by spinning tension. In general, increasing spinning tension had very little effect on yarn strength, irrespective of differences in fiber elongation. However, yarn skein and single-strand breaking strengths did not respond similarly to spinning tension. It was demonstrated that cottons differing in fiber elongation can be spun into yarns of the same elongation when spun under different tensions. Based on these findings, it is postulated that mills may process high elongation cotton to better advantage than low elongation cotton in terms of production rate.

2229. NEW METHODS FOR IMPROVING THE WEAR RESISTANCE OF WASH-WEAR COTTON COLLAR AND CUFF MATERIALS. (S.R.R.L. Study finds Promise in Bonding Untreated Cotton to an Interliner with Wash-Wear Properties.) Fenner, T. W.; Reinhardt, R. M.; and Reid, J. D. Textile Bull. 87, (11) 41-42, 44. 1961.

New methods for the production of cotton collar and cuff materials with wash-wear properties and good abrasion resistance have been investigated. Among the more promising approaches to this objective is that of bonding untreated cotton to an interliner which has wash-wear properties; that is, one which is wrinkle resistant and smooth drying. Thin polyurethane foam and resin-treated cotton have been successfully used as interliners.

2230. CRYSTALLITE ORIENTATION AND SPIRAL STRUCTURE OF COTTON. PART I. NATIVE COTTONS. DeLuca, L. B.; and Orr, R. S. J. Polymer Sci. 54: 457-70. 1961.

A method is demonstrated by which both crystallite orientation and spiral angle can be directly determined from the x-ray tracings of the 002 diffraction arcs of combed bundles of cotton fibers. Sisson has shown, qualitatively, that the 002 arcs displayed by fibers with a spiral structure can be explained by assuming two equal crystallite distributions separated by twice the spiral angle. If this distribution of crystallites is assumed to be Gaussian, the experimental arc can be generated theoretically. Such an analysis is applied to several cottons of widely different orientations and the calculated parameters are compared with those of the gross arcs.

2231. CRYSTALLITE ORIENTATION AND SPIRAL STRUCTURE OF COTTON. PART II. DECRYSTALLIZED AND MERCERIZED COTTONS. DeLuca, L. B.; and Orr, R. S. J. Polymer Sci. 54: 471-89. 1961.

A method is demonstrated by which both crystallite orientation and spiral angle can be directly determined from the x-ray tracings of the 002 diffraction arc of combed bundles of cotton fibers. Balls has shown that cotton has a spiral structure and Sisson has shown, qualitatively that these 002 arcs can be explained by applying two equal crystallite distributions separated by twice the spiral angle. If this distribution of crystallites is assumed to be Gaussian distribution, the experimental arc can be generated theoretically. This method of analysis is applied to x-ray data for decrystallized and mercerized cottons. X-ray diffraction shows the effects on fine structure of after-treatments, such as tension and boiling in water, applied to samples of slack amine-decrystallized and mercerized cotton yarns. The comparison of the calculated parameters with those of the gross arcs are given, as well as the relationships of these quantities to the tensioning force which produced them.

2234. THE ARCHITECTURE OF CELLULOSE: A MICROSCOPIC REVIEW. Rollins, M. L.; and Tripp, V. W. Forest Prod. J. 11: 493-504. 1961.

Cotton, representing the purest form of cellulose in nature, is explored as the general fiber type. The structure of wood tracheids and of the walls of bast and leaf fibers are referred to the morphology of cotton hairs. Classical microscopical investigations have demonstrated a natural architectural arrangement of concentric layers of cellulose encased in a skin or primary wall containing noncellulosic substances. By electron microscopy, the cellulosic portion of the primary wall is shown as a network of fibrils interlaced into a two-faced fabric impregnated with the noncellulosic constituents. Beneath the primary wall from 25 to 40 concentric layers of cellulose constitute the



secondary wall or main body of the fiber. In these the microfibrils lie parallel in a closely packed continuous system. The dimensions and fine structure of individual microfibrils and their disposal in the gross morphology of the fiber are discussed. Consideration of various aspects of cellulose behavior is given in relation to microscopically observed phenomena in physical and chemical modifications of cotton fibers.

2235. A CARBAMATE FINISH FOR WRINKLE-RESISTANT AND "WASH-AND-WEAR" COTTONS. Arceneaux, R. L; Frick, J. G., Jr.; Reid, J. D.; and Gautreaux, G. A. Am. Dyestuff Repr. 50, P849-P853. 1961.

A finishing agent for cotton fabric has been prepared from the reaction of two molar equivalents of formaldehyde with a monocarbamate, typically ethyl carbamate (urethane). The N,N-dimethylolcarbamate is presumably formed in the reaction. The finish gives cotton wrinkle resistance and "wash-and-wear" properties without susceptibility to chlorine damage. In addition, the finish is very durable in comparison with other nitrogenous finishes, particularly because of its high resistance to acids and laundry sours.

2238. THE USE OF COREACTANT CURING AGENTS WITH A DIEPOXIDE TO IMPART WRINKLE RESISTANCE TO COTTON FABRICS. Reinhardt, R. M.; Kullman, R. M. H.; Moore, H. B.; and Reid, J. D. Textile Research J. 31: 941-50. 1961.

Wrinkle resistance can be imparted to cotton fabrics with a diepoxide when certain coreactant curing agents are used. Such materials coreact to become a part of the finished product and introduce linkages and chemical groups which differ from those obtained when a true catalyst is used. Several coreactants including, for example, phthalic anhydride, citric acid, 1-aminoethyl-2-methyl-imidazoline, triethanolamine, and potassium thiocyanate, were used with 1,3-diglycidylglycerol as the diepoxide. In some cases more deposition seemed to occur, while in other cases crosslinkage was accomplished. Some indications of the types of reaction were obtained from infrared data and from the responses of the treated fabrics to various classes of dyes. In some cases coreaction between the diepoxide and the curing agent appeared to take place at relatively low temperatures, producing improved wrinkle resistance. Phthalic anhydride was used to investigate this aspect in more detail. For comparison with the coreactant materials, several acid salts were used as catalysts, and the results are reported. Among the more suitable acid catalysts are magnesium perchlorate, aluminum sulfate, and zinc fluoborate. The inorganic acid catalysts produced fabrics with excellent durability and wrinkle resistance. Tearing strength losses, however, were greater with epoxide-treated cotton than those observed, at equivalent crease recovery angle, when a typical methylolamide finishing agent with catalyst was used. The durability



to alkaline solutions of some of the epoxide finishes applied with coreactant curing agents was not as good as that of fabrics prepared with the inorganic acid catalysts. Tearing strength and wrinkle resistance of epoxide-treated cotton can be improved by inclusion of additives such as polyethylene, acrylic polymer, or silicone, in the finishing bath.

2239. GRAFT POLYMERS OF COTTON CELLULOSE AND ACRYLONITRILE INITIATED BY RADIATION. Arthur, J. C., Jr.; and Demint, R. J. Textile Research J. 31: 988-89. 1961.

Graft polymers of cotton cellulose and acrylonitrile have been made as evidenced by (1) unextractable polymer add-on; (2) decreased cellulose solubility; and (3) decreased OH band intensities for purified cotton, indicating grafting induced at the OH radical on the cellulose molecule. In the case of cyanoethylated cotton, the relative constancy of the OH band intensities probably indicated grafting at the cyanoethyl group.

2240. CONCERNING SOME ASPECTS OF THE REACTION BETWEEN UREA AND CELLULOSE. Segal, Leon; and Eggerton, F. V. Textile Research J. 31, 991-92. 1961.

An explanation is given for not citing D. D. Gagliardi in a recent paper by the authors. A detailed consideration is given of why molten urea is not thought to be the reactant in the urea-cellulose reaction, and how data presented by A. C. Neussle fits into these considerations.

2242. THE OXIDATIVE DEGRADATION OF COTTON BY HYPOCHLORITE. Epstein, J. A.; and Lewin, Menachem. Bull. Res. Counc. of Israel 10A, (3) 37-38. 1961.

In cotton oxidized by hypochlorite at pH values between 5 and 10, carboxyl group content increases while aldehyde and ketone group content decreases with increase in pH. Degradation of the cotton was found to be random in the whole of the pH range studied. It is suggested that the degradation and oxidation reactions occur simultaneously at a given pH, with similar rates, so that all carbon atoms of an AGU in all chains of the amorphous phase will have a similar probability of being attacked. Two references are listed.

2243. A REARRANGEMENT OF SOME ALKOXYPHOSHAZENES. Fitzsimmons, B. W.; and Shaw, R. A. Proc. Chem. Soc. (London) 1961, 258.

The completely ethoxylated derivatives of  $(\text{PNCl}_2)_3$  and  $(\text{PNCl}_2)_4$  are reported. Heating at  $200^\circ$  for 1 hour causes rearrangement of the trimeric and tetrameric ethoxylated compounds to form the crystalline N-ethyl isomers. Spectra data is given which shows the disappearance any characteristic (P-N) bands which were present before rearrangement. Rearrangement is thought to take place by a mechanism in which a ring nitrogen atom attacks an  $\alpha$ -carbon atom of an alkoxyl group. Comparison to analogous thermal decompositions are given. Six references are listed.



2245. STUDIES OF THE ETHYLENEDIAMINE-CELLULOSE COMPLEX. IV. DECOMPOSITION OF THE COMPLEX BY DIMETHYLFORMAMIDE. Segal, Leon. J. Polymer Sci. 55, 395-409. 1961.

Dimethylformamide applied at 100°C. and at the boil to ethylenediamine-cellulose complexes decomposed the complexes, giving products whose x-ray diffractograms are almost identical with that of cellulose IV prepared by means of glycerol at 250°C. The product derived from cellulose II has a 002 interplanar spacing of 4.04 Å., those from cellulose I and III have a spacing of 3.98. The 10 $\bar{1}$  AND 101 interplanar spacings are the same for all the products, 5.71 Å. The infrared spectra of the products are markedly similar to those of the original cellulosic starting materials, except in the case of cellulose III. This modification has a cellulose II type of infrared spectrum; that of the product is markedly similar to the infrared spectrum of cellulose I. Application of sodium hydroxide solution and of ethylenediamine to the decomposition products of the complexes produced cellulose II and the ethylenediamine-cellulose complexes, respectively. Anhydrous ethylamine failed to produce cellulose III.

2248. METHOD OF MEASURING TORSIONAL RIGIDITY OF FIBERS AT ELEVATED TEMPERATURES AND PRESSURES. Orr, R. S.; and Grant, J. N. Textile Research J. 31: 1073-75. 1961.

A simple apparatus is described for measuring the torsional rigidity of fibers at elevated temperatures and pressures up to 70 psi. The apparatus was used for studying effects of temperature and vapor pressure of water on the properties of untreated, mercerized, benzylated, and fully acetylated cottons.

2249. CROSS-LINKING COTTON WITH DIMETHYLOL UREA AND ALKALINE CATALYST. Arceneaux, R. L.; and Frick, J. G., Jr. Textile Research J. 31: 1075-76. 1961.

It has been shown that dimethylol urea can be etherified in methanol to the dimethyl ether using an alkaline catalyst. Since similar fabric properties are obtained by treatment with dimethylol urea and either acid or alkaline catalysis, it is concluded that cellulose can be cross-linked by an alkaline catalyzed etherification reaction.

2250. A MODIFICATION OF THE METHOD FOR DEFINING AND MEASURING CRIMP OF TEXTILE FIBERS. Shiloh, M.; Goldstein, J.; Mejzler, D.; and Alexander, E. Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry, Jerusalem, Israel. Textile Research J. 31: 999-1006. 1961. [Condensed version entitled "A New Method for Measuring and Defining Crimp of Textile Fibres" by M. Shiloh, D. Mejzler and E. Alexander published Bull. Res. Council of Israel, 10C, (1-3) 89-91. 1961.]

The main parameter used to describe the geometry of the crimp of a fiber is the crimp diameter. This corresponds to an average amplitude



of the fiber in space while the fiber is kept in a static position of stress. In order to measure the crimp diameter, it is necessary to measure the coordinates of a sufficient number of points on the fibers. From these measurements, a "fiber axis" can be defined as the straight line for which the sum of squares,  $S$ , of the distances of the fiber points from this line is minimal. The crimp diameter is then defined as  $D = 2\sqrt{S/N}$ , where  $N$  is the number of points measured along the fiber. The calculation of  $S$  according to this definition involves the solution of third-order equations. Therefore a simplified equation is suggested. It was found that this equation can, for all practical purposes, serve as a satisfactory approximation for the results obtained when  $S$  is calculated according to the definition, i.e., from the fiber axis. In order to measure the crimp diameter, a special apparatus had to be built. A series of limitations of the rotatory crimp apparatus led to the modification of the measuring method and to the development of the method of two perpendicular planes. This method was applied to various types of fiber, such as cotton and fine wools.

2251. THE PYROLYSIS OF CELLULOSE AND THE ACTION OF FLAME-RETARDANTS. I. SIGNIFICANCE AND ANALYSIS OF THE TAR. Holmes, F. H.; and Shaw, C. J. G., The British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester 20, England. J. Appl. Chem. 11: 210-16. 1961.

A study has been made of the pyrolysis of different cottons in vacuum, and in dry air, mainly at  $418^\circ$  and the products have been fractionated and analysed. From a purified cotton cellulose, the main products are a combustible tar and water, but when a flame-retardant is present less tar and more gas and carbonaceous residue (char) are produced. The tar is highly flammable, and is a major factor in the burning of cotton. There is a correlation between the amount of tar formed and the flammability of the cotton. Removal of the impurities from the cotton cellulose leads to the formation of more tar on pyrolysis. The tar is a mixture of organic compounds of which the major component is laevoglucosan. Acids, carbonyl compounds and unsaturated compounds have been found and determined quantitatively. It is concluded that for a treated cotton cellulose material to be flame-resistant the amount of tar formed on pyrolysis must be small.

2255. INCREASE OF INSTRON SENSITIVITY AS AN AID TO THE STUDY OF THE MECHANICAL PROPERTIES OF COTTON FIBERS. Goldschmidt, D.; and Shiloh, M. Textile Research J. 31: 1071-72. 1961.

The sensitivity of the Instron tester using the "A" load cell was increased from 0-2 g to 0-200 mg full scale reading. The increased sensitivity was accomplished by increasing gain on load amplifier through reduction in feedback voltage in latter two stages. Other but less desirable methods of increasing sensitivity are given. At the



higher sensitivity pen drift occurs but increased sensitivity needed in evaluating the load-elongation behavior of cotton fibers during their uncrimping overcompensated for the slight error in short period drift.

2256. MERCERIZATION OF COTTON FIBERS WITHOUT TENSION. Rutherford, H. A.; Bogdan, J. F.; Woo, H. K. C.; and Ghosn, H. S. Am. Dyestuff Reprtr. 50: 910-18, 942. 1961.

The physical properties and chemical behavior of mercerized cotton fiber produced by tensionless procedures were investigated. Studies were first made relative to the optimum concentration of caustic soda for tensionless mercerization. No further changes in length, denier, strength, and elongation of cotton fibers were found beyond a concentration of sodium hydroxide of 16%. The fiber breaking load and denier were increased but the tenacity of the single fibers was decreased. The maximum shrinkage was about 15%, and the increase in elongation at break was from 7.5% for the untreated fiber to 12% for the mercerized fiber. Card sliver was the best form in which to mercerize the fiber, and a manufacturing organization for producing yarn from the mercerized sliver was developed. These yarns showed higher elongation and better strength and appearance than that spun from untreated cotton. The increase in elongation of the single fibers mercerized without tension was not completely utilized in the yarn, the maximum elongation of the yarn being 10.7%. Recovery behavior revealed that the yarn made from the untreated fiber was superior in recovery to yarn made from the mercerized sliver. In all respects the same conclusions were reached with regard to yarn properties, whether singles or ply yarns were used. Both knitted and woven fabrics were made. For grey fabrics, the warp crimp of the untreated and the fiber-mercerized yarns was much higher than the yarns skein-mercerized both with and without tension. The filling crimp of the untreated was the highest among the four samples. For greige fabrics in the warp direction, the elongation-at-break of skein-mercerized both with or without tension was less than the untreated, while the fiber-mercerized treatment produced a fabric which had the highest elongation. In the filling direction, the fabric made from yarn skein-mercerized without tension, and that made from fiber-mercerized yarns possessed higher elongation-at-break than the untreated material. No definite conclusions could be drawn relative to the comparative strengths of the various fabrics. Considering the data obtained by different methods of evaluation, strengths appeared to be very nearly the same for all materials. The receptivity to dyes and resins of the fabrics was determined. As in the case of the other properties cited for the mercerized materials, there was no advantage gained with respect to resin treatment or dyestuff receptivity by stock mercerization.

PATENTS

2258. PROCESS FOR PRODUCTION OF PERFLUOROALKANOYL ESTERS OF CELLULOSE.  
U. S. Pat. No. 2,992,881, July 18, 1961. Berni, R. J.; and  
Fagley, T. F.

A process for the production of the perfluoroalkanoyl esters of cellulose. The products of this invention are unique in that the esters produced are durable to dry cleaning and durable to water washing in the presence of neutral detergents.

2260. CELLULOSE ESTERS WITH DIMENSIONAL STABILITY. : U. S. Pat.  
No. 2,993,749, July 25, 1961. Sloan, W. G.; DuPre', A. M., Jr.;  
Buras, E. M., Jr.; Janssen, H. J.; and Tallant, J. D.

A process for producing chemically modified cellulosic textiles that exhibit dimensional stability. The process involves the curing of fibrous cellulose esters and ethers under the influence of heat and tension.

2261. PROCESS FOR THE REACTION OF ISOCYANATES WITH CELLULOSE IN THE  
PRESENCE OF ORGANIC PHOSPHITES. U. S. Pat. No. 2,993,888,  
July 25, 1961. Welch, C. M.

This invention relates to the reaction of isocyanates with cellulose. The invention involves the use of a new class of accelerators for this reaction, namely, the alkyl phosphites. The use of the new phosphite catalyst allows the reaction of cellulose and organic isocyanates to be carried out without serious degradation and depolymerization of the cellulose.

2265. APPARATUS FOR MEASURING THE ABSOLUTE SOFTNESS OF YARNS.  
U. S. Pat. No. 3,004,428, October 17, 1961. Skau, E. L.

An apparatus for measuring the absolute softness of yarns in terms of the percent increase in yarn width when subjected to lateral pressure between two parallel plane surfaces.



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1962

Compiled and Edited  
by  
Marie A. Jones and Charlotte Duffy

Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

Issued April 1963





2270. QUICK TEST FOR OILY COTTON (Identification and properties of oil-contaminated cotton). Honold, E.; Andrews, F. R.; and Grant, J. N. Textile Inds. 126, (1) 83-86. 1962.

Increased mechanization in the production and harvesting of cotton increases the possibility of the cotton becoming contaminated with machinery lubricants. A simple and rapid test is described to detect the presence of oil on seed cotton or on cotton lint even after the oil has been thoroughly dispersed throughout the cotton by mechanical processing. The test is based on the fluorescence under ultraviolet light of a hexane extract of the oil. Heavily contaminated cotton has poor processing qualities which are not improved by heating the cotton to remove the oil, but are improved by blending with uncontaminated cotton.

2272. BLENDING FOR QUALITY: A SPECIFIC CASE OF BLENDING MEDIUM AND EXTRA LONG STAPLE COTTONS (S.R.R.L. Study Shows Cottons Can Be Blended to Produce A Specified Fiber Length Distribution). Louis, G. L.; and Fiori, L. A. Textile Bull. 88, (1) 38-41. 1962.

Medium-staple Deltapine 15 and extra-long-staple Pima S-1 cottons were blended in different percentages to study the combined effects of these cottons on single yarn properties and spinning performance. It was found that cottons differing in staple length can be blended to a projected fiber length distribution. Also, fiber length distribution properties of the blended lots are improved through increased percentages of long fibers. Blending the Pima S-1 cotton into the Deltapine 15 cotton, even in small amounts, increased spinning performance and improved yarn properties, particularly strength and elongation-at-break.

2278. THE EFFECT OF THE SHORT FIBERS IN A COTTON ON ITS PROCESSING EFFICIENCY AND PRODUCT QUALITY. PART IV: GREY AND FINISHED FABRICS. Tallant, J. D.; Fiori, L. A.; and Sands, J. E. Textile Research J. 32, 50-57. 1962.

Print cloth fabrics (80x80) were produced from yarns spun from cotton containing different percentages of short fiber. In the case of all fabric properties measured, with the exception of crease angle, increasing short fiber content resulted in significant changes adverse to quality, i.e., in decreased strength, elongation, flex abrasion, and tearing strength. Subjective properties such as appearance and hand were also degraded as the short fiber content increased. The above conclusions apply equally to fabrics in the grey, bleached, mercerized and dyed, and resin-treated states. No conclusions could be drawn as to the effect of short fibers on weaving performance, because of the limited quantity of experimental material available.

2280. THE EFFECT OF THE UNSATURATED GROUP ON THE WEATHERING OF CHEMICALLY MODIFIED COTTONS. Wade, R. H.; Hamalainen, C; and Cooper, A. S., Jr. Am. Dyestuff Repr. 51, 45-48. 1962.

Fibrous cellulose esters with reactive unsaturated groups, such as the cinnamate, crotonate, and sorbate, undergo a photochemical reaction having the effect of accelerating degradation caused by weathering. Grouping samples into unsaturated and saturated esters upon the basis of their weathering characteristics was shown statistically valid at the 95% confidence levels.

2284. THE S.R.R.L. NON-LINT TESTER: A RAPID METHOD FOR DETERMINING TRASH CONTENT OF COTTON. Rusca, R. A.; and Latour, W. A. Textile Bull. 88, (2) 45-48. 1962. (Also published Proc. Cotton Research Clinic, 1962, 11-13.)

A new machine and method developed by the Southern Laboratory for determining nonlint content of lint cotton has shown much promise. Results of the new method correlate highly with the A.S.T.M. method, and the test procedure is simple and rapid. Following further evaluations on a wide range of cottons, it is anticipated that the nonlint tester will become commercially available the latter part of the year.

2287. RESEARCH: ANSWER TO COTTON'S CHALLENGE. Cheatham, R. J.; and Bourdette, V. R. Southern Textile News 17, (39) 25, 27. 1961.

World consumption of cotton during the past 160 years and the factors influencing this consumption are briefly discussed. It is pointed out that studies have shown that quality, price, and sales promotion influence textile consumption and indicate that research to improve quality and to lower costs offer the greatest opportunity for maintaining present markets and finding new uses for cotton. The objectives of cotton utilization research are discussed, including that on wash-wear cotton products, and the importance of this development in retaining markets for cotton. The need for additional research on wash-wear products and other areas where research is needed are discussed.

2293. SOME EFFECTS OF THE NATURE OF CROSS-LINKS ON THE PROPERTIES OF COTTON FABRICS. Reeves, W. A. J. Textile Inst. 53, (1) P22-P36. 1962.

An attempt is made to analyse some of the factors that affect crease-resistant properties of cotton to provide a better understanding on which to make new advances. Investigations are reported on the types, chemical nature, and distribution of cross-links in cottons. The relative merits of covalent-bond and hydrogen-bond cross-links for imparting wash-wear properties



are considered. Substituent groups on carbonyl carbon and amido nitrogen atoms of N-methylol cross-linking agents influence acid and base hydrolysis of the reaction products of the compounds with cotton cellulose. Some factors affecting wet and dry crease-recovery are discussed. Structures within the cotton fibre that are capable of slippage, thus resulting in fibre creasing, are considered with respect to the present concept of the fibre structure.

2297. THE EFFECTS OF GAMMA RADIATION ON COTTON. PART IV: APPARENT ENERGY OF ACTIVATION OF VISCOUS FLOW FOR DILUTE SOLUTIONS OF IRRADIATED COTTONS. Arthur, J. C., Jr.; and Demint, R. J. Textile Research J. 32, 108-11. 1962.

The interaction of high-energy radiation with cellulose, which leads to the formation of free radicals, excited atoms, or chemical groups, gave decreased intermolecular bonding. This decreased bonding was probably due to the decreased number of interacting anhydroglucose units per molecule. The enthalpy of activation of viscous flow of dilute solutions of purified and irradiated cottons was relatively constant. The entropy of activation of viscous flow was negative and directly related to the molecular weight of the celluloses. Consequently, the free energy of activation of viscous flow for dilute solutions of irradiated cottons was less than for purified cotton. This indicated decreased intermolecular bonding in the irradiated cottons as compared with purified cotton.

2298. BETTER DIMENSIONAL STABILITY FOR ACETYLATED COTTONS. Sloan, W. G.; Tallant, J. D.; and Hobart, S. R. Textile Inds. 126, (3) 109, 115, 121-122. 1962.

The dimensional stability of partially-acetylated and fully-acetylated yarns and fabrics has been improved by heat-stressing treatments which are described. Heat-stressing for as little as 30 seconds caused considerable reduction in elongation-at-break, a sharp increase in secant modulus, and more importantly, considerable reduction in growth or permanent set after cyclic loading. Breaking strengths of the yarns and fabrics were not adversely affected by the heat-stressing treatment. Data are given for partially-acetylated and fully-acetylated yarns and fabrics after treatment at temperatures ranging from 100 C to 245 C, and under loads up to 50% of breaking strength. Best results were achieved by heat-stressing for 30 seconds at 200 C under a load equal to 20% of the breaking strength.

2299. CONTROL OF FORMALDEHYDE RELEASE FROM FABRIC FINISHED WITH DIMETHYLOL ETHYLENEUREA. Reid, J. D.; Reinhardt, R. M.; Fenner, T. W.; and Harris, J. A. Am. Dyestuff Reprtr. 51, 150-53, 157. 1962.

Several methods for diminishing the amount of formaldehyde released from fabric treated with dimethylol ethyleneurea (DMEU) were studied.

Afterwashes, aftertreatments, and finishing pad bath additives were investigated. The formaldehyde evolved was measured after an accelerated storage test. The effect of treatments to control formaldehyde release on wrinkle resistance and chlorine resistance of the "wash-and-wear" fabric was determined. The study was limited to cotton cloth treated with DMEU and zinc nitrate catalyst, but the results are believed to be generally applicable to fabric finished with the various types of N-methylol finishing agents. Oxidative and alkaline afterwashes were effective in controlling formaldehyde evolution with no adverse effect upon wrinkle-resistance or chlorine resistance. Many of the other treatments studied were inefficient in satisfactorily diminishing the release of formaldehyde or produced undesirable side effects on important "wash-and-wear" properties of the fabric. Dicyandiamide ethyleneurea, urea, and sodium metabisulfite as aftertreatments all reduced formaldehyde release in the finished cotton.

2301. THE DEGRADATION OF COTTON CELLULOSE BY THE EXTRACELLULAR CELLULASE OF MYROTHECIUM VERRUCARIA [PL-480 Grant]  
Selby, K. (Shirley Institute, B.C.I.R.A., Didsbury, Manchester 20, England) Biochem. J. 79, 562-66. 1961.

Extracellular extracts of *Myrothecium verrucaria* have been used to study the mechanism of cellulase action on unmercerized and mercerized cotton cellulose. Relations between loss of weight during hydrolysis and (1) decrease of viscosity-average degree of polymerization and (2) the further loss of weight on heating with alkali have been determined and compared with results similarly obtained by (a) acid degradation of unmercerized cellulose and (b) enzymic degradation of swollen cellulose. These comparisons suggest that the enzyme, being composed of large molecules with restricted mobility in the substrate, removes a number of adjacent glucose residues from each of relatively few sites of attack.

2302. MORE EFFICIENT USE OF HIGH SHORT FIBER CONTENT COTTON THROUGH SELECTION OF SPINNING VARIABLES. Tallant, J. D.; Fiori, L. A.; Groves, N. H.; and Kingsbery, E. C.  
Textile Bull. 88, (3) 45-48. 1962. (Also published Proc. Cotton Research Clinic, 1962, 14-17.)

Acala 44 cotton of three levels of short fiber content was obtained and processed into 36/1 warp yarns. Using the 720 spindle-hour technique, the relation of spinning efficiency to spindle speed was obtained for three levels of draft and two different weight travelers. End breakage during spinning (ends down per thousand spindle hours) decreased with reductions in short fiber content. Also, reductions in spinning draft improved the spinning performance of all cottons. For a given cotton and a constant spinning efficiency (50 ends down per thousand spindle hours) reductions in spinning draft permitted increased spindle speeds. The increase was approximately proportional to the square root



of the ratio between the high and low drafts used. Other implications are that, for a given spindle speed, spinning draft reductions applied to high short-fiber content cotton may make it perform in spinning similarly to a cotton with "normal" short fiber content. The cottons showed substantially the same pattern of response, although at different levels, for the two weights of travelers used. Yarn skein strength was found to decrease with increased spindle speeds although at the low rate of less than 1% for each 1,000 r.p.m. increase.

2303. AN INVESTIGATION OF CROSS-SECTION SAMPLING METHODS  
SUITABLE FOR DETERMINATION OF THE FIBER LENGTH  
DISTRIBUTION OF COTTON. Gaffney, H. E.; Armitage, R. H.;  
and Tallant, J. D. Textile Bull. 88, (3) 60-65. 1962.  
(Also published Proc. Cotton Research Clinic, 1962,  
36-41.)

Various attempts to produce rapidly a specimen suitable for determining the fiber length distribution of cotton by scanning are briefly described. The most successful technique seemed to be the stitching of cotton fibers to a plastic backing. To avoid excessive fiber breakage and consequent distortion of the fiber length distribution, it was found desirable to use parallelized cotton fibers such as those from sliver. The time required to produce a specimen was found to be about 1-1/4 minutes.

2396. FURTHER AUTOMATION OF THE SRRL WRINKLE RECOVERY TESTER.  
Haydel, C. H.; and Sloan, J. M. Am. Dyestuff Reprtr.  
51, 192-93. 1962.

The construction, operation, and accuracy of a tester, developed at the Southern Regional Research Laboratory, for measuring automatically the wrinkle-recovery angle of woven fabrics in accordance with the tentatively approved official vertical strip method was described in a recent publication. Since that time, means for automatically pressing the specimen and other modifications have been incorporated in the tester for complete automation of the entire wrinkle-recovery-angle measurement. These new features are described in this paper.

2307. USDA RESEARCH SERVICE AIDING TEXTILE INDUSTRY. Patton, E. L.;  
and Decossas, K. M. Southern Textile News 18, (12) 28-29.  
Mar. 24, 1962.

The effect of successful cooperation between the Southern Utilization Research and Development Division and the United States textile industry on our national cotton economy is reviewed. Aid from the industry and agricultural experiment stations is described. Support received in the form of funds, a research fellowship, and use of equipment from various associations is acknowledged, and presentation of research results is summarized. Results of cooperative work are reported on stretch cottons, wash-wear, flame-resistant cottons, the

formic acid colloid of methylolmelamine treatment, and on various cotton mechanical processing developments such as the SRRL Cotton Opener, SRRL Opener-Cleaner, SRRL Granular Card and the SRRL Aerodynamic Cleaner. Members of the textile industry are invited to play an increasingly important role in our future.

2308. LABORATORY EVALUATION ATTESTS RELIABILITY OF THE S.R.R.L. ACCELERATED SPINNING TEST. Louis, G. L.; and Fiori, L. A. Textile Bull. 88, (4) 31-35. 1962. (Also published Proc. Textile Quality Control Association, Spring 1962, 4-9.)

A laboratory-scale evaluation to test the sensitivity and reproducibility of the S.R.R.L. Accelerated Spinning Test was made using three series of cottons differing widely in fiber maturity, strength and bundle elongation. End breakage data obtained from the S.R.R.L. Accelerated Spinning Tests were compared with that obtained from 5,000 spindle-hour control tests. Results showed good correlation between the S.R.R.L. Accelerated Spinning and the 5,000 spindle-hour tests and that the former test is reliable, sensitive and reproducible enough for quickly evaluating the spinning performance of cottons. The 5-1/2 hours required to test a cotton is relatively short, and the small amount of cotton required is an advantage. The mechanics and a testing procedure of the test are reviewed and related data appended.

2309. KING COTTON GETS A "STRETCHY" CROWN. Fisher, C. H.; and Bourdette, V. R. Cotton Gin & Oil Mill Press 63, (7) 10-11. 1962.

The paper briefly outlines research on the development of all-cotton stretch yarns and fabrics and indicates what the developments may mean to the cotton industry and to consumers.

2310. COTTON'S STATUS STRENGTHENED BY WORK AT SRRL. Cheatham, R. J. Cotton Trade J. 42, (13), Special Suppl., 1, 10. 1962.

The types of cotton utilization research being currently conducted by the Southern Regional Research Laboratory and the methods used to plan and execute the research efforts are described. Some highlights of the current research program, such as new processes for producing stretch-type and bulky cotton textiles, new wash-wear finishes, investigations of fiber properties and processing variables to improve product properties and spinning performance, and new machinery developments are discussed. Some additional types of research which are urgently needed are listed.

2311. CRYSTALLITE ORIENTATION AND SPIRAL STRUCTURE OF COTTON: CONSIDERATIONS FOR MEASURING CRYSTALLINITY. DeLuca, L. B.; and Orr, R. S. Textile Research J. 32, 243-44. 1962.

Before crystallinity of a cotton fiber can be determined from x-ray measurements of fiber bundles, both the radial and azimuthal scans



are needed. A method is developed in which the equatorial arcs can be analyzed at any radial position to determine the true arc intensity in those regions where intensity contributions from other diffraction arcs interfere. Postulates are also presented to account for the "anisotropic background" of cellulose.

2312. X-RAY DIFFRACTOMETER THERMAL TECHNIQUE FOR STUDY OF STRUCTURAL CHANGES IN CELLULOSIC COMPOUNDS. Creely, J. J.; and Conrad, C. M. Textile Research J. 32, 184-89. 1962.

Previous x-ray diffraction studies of cellulose derivatives and other organic compounds have shown that heat often has important effects, facilitating crystallization, transitions, and polymorphic transformations. However, the application of heat treatments in conjunction with x-ray diffraction studies has usually been laborious, inexact, and at times ambiguous because of limitations of the technique. The present paper describes the adaption of an x-ray furnace in conjunction with a two-pen potentiometer recorder and temperature-program controller to overcome some of the previous limitations. A specially-designed specimen holder is described. Thermal diffractograms of cellulose acetate and of benzyl and cyanoethyl cellulose are reproduced to demonstrate some of the advantages and possibilities of this technique.

2313. BLENDING FOR QUALITY. BLENDING - A MEANS OF MAINTAINING QUALITY IN COTTON PRODUCTS. Fiori, L. A.; and Louis, G. L. Textile Inds. 126, (4) 110-15, 119, 121, 162. 1962.

In this article four major topics are discussed: Principles of recent developments in blending techniques and problems of blending; theoretical reasons and experimental proofs why cottons of contrasting fiber properties can be blended successfully; some speculative ideas about types of cotton blends which might be used successfully; and suggestions for improving blending practices. To obtain the ideal fiber blend, it is necessary to: Feed small tufts of cotton of about equal size to the hopper feeders; feed by weight rather than by volume; keep a constant density of cotton in the hopper; and arrange the bale laydown to allow for the "time-space" factor, either by preblending or other means in the preparatory operations, basing the bale selections on specific fiber properties, particularly fineness and fiber length distribution (short-fiber content).

2314. IMPARTING DRY WRINKLE RESISTANCE TO COTTON TREATED IN THE SWOLLEN STATE WITH FORMALDEHYDE. Fenner, T. W.; Reinhardt, R. M.; and Reid, J. D. Am. Dyestuff Reprtr. 51, 224-28. 1962.

A process has been studied for imparting dry wrinkle resistance to Form W cotton, that is, cotton which has been treated in the swollen state with formaldehyde. By this process, Form W cotton is impregnated with an acid or latent acid catalyst, subjected to a

heat-treatment step, and afterwashed. Many variables in the treatment that affect the final product were examined. As compared with Form W cotton, the treated Form W cotton has greatly improved dry wrinkle resistance and thus a higher "wash-wear" rating after being tumble-dried. Breaking strength and tearing strength were somewhat decreased, but wet wrinkle resistance, moisture regain and durability of the finish were practically unaffected.

2315. THE MILD OXIDATION OF COTTON BY HYPOCHLORITE [PL-480 Grant] Epstein, J. A.; and Lewin, Menachem (Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry, Jerusalem, Israel). Textil-Rundschau 16, (9-10) 494-510. 1961.

The mild oxidation of crude and purified cotton by hypochlorite solutions at the pH range 5-10 was studied. The dependence of the rate of the oxidation on pH and initial concentration of hypochlorite and cotton is expressed by

$$-\frac{dC}{dt} = k (\text{HOCl})^2 (\text{ClO}^-)^{1/2} (\text{Cotton})^{1/2} / (\text{Cl}^-)^{1/2}$$

The carboxyl groups content of oxidized cotton increases while the aldehyde and ketone groups content decreases with increase in pH. 26 atoms of oxygen are consumed per scission, out of which 10.4 atoms are accounted for by the functional groups. The degradation was found to be random at the whole pH range studied as proved by the ratio of the number average and weight average molecular weights and by the linearity of the plot of  $\log(n)$  v.s.  $\log(\text{O}_c - \text{O}_{\text{CO}})$ , the consumed oxygen. The "dangerous pH zone" 6-8 is caused only by the increased reaction rate and not by a particular degradation reaction. The ratio of carboxyl, aldehyde and ketone groups formed per scission are 1-1.5:3:5:5 at the acidic pH range and 5:0.8:0.0 at pH 10. A tentative mechanism is suggested by which the reaction proceeds through a free radical mechanism involving the OH radical and the hydroperoxide  $\text{Cl}_2\text{OOH}$ . The degradation and oxidation reactions occur simultaneously and at a given pH with similar rates, so that all carbon atoms of anhydro-glucose units in all chains of the amorphous phase will have a similar probability of being attacked.

2318. APO, A DURABLE FLAME RETARDANT FOR COTTON. Drake, G. L., Jr.; Chance, L. H.; Beninate, J. V.; and Guthrie, J. D. Am. Dyestuff Repr. 51, 272-74. 1962.

Flame-resistant cotton fabrics have been prepared by treatment of fabric with an aqueous solution of tris(1-aziridinyl)phosphine oxide (APO) without the use of tetrakis(hydroxymethyl)phosphonium chloride (THPC). Wrinkle, rot, mildew, and glow resistance are imparted to the fabric in addition to flame resistance. The treatment may be applied on conventional textile finishing equipment.



2322. ALL-COTTON STRETCH AND BULKED YARNS AND FABRICS.

Fisher, C. H. Textile Research J. 32, 313-20. 1962.

Progress in developing cotton fabrics having high recoverable stretch, durable loft, warmth, and other highly desirable properties is reported. Three general methods for making stretch and bulked cotton yarns and fabrics are described: (1) use of cross-linking agents to set or maintain crimp in cotton yarn; (2) slack mercerization of cotton fabrics to cause shrinkage; and (3) the crimping and heat-setting of thermoplastic cotton yarns (ethers and esters of cotton cellulose). The first method employs the chemical reactions of the type widely used by industry in manufacturing wash-wear products. Stretch and bulked cottons might present opportunities equal to those already provided by wash-wear products.

2323. ELECTRONIC EFFECTS OF SUBSTITUENT GROUPS UPON ACID HYDROLYSIS OF AMIDO-METHYLOL FINISHES ON COTTON.

Reeves, W. A; Vail, S. L.; and Frick, J. G., Jr.  
Textile Research J. 32, 305-12. 1962.

The results of a study on the susceptibility to acid hydrolysis of the products from the reaction of amido-methylol compounds with cotton are reported. A correlation was found between electron displacement and ease of hydrolysis. Substituent groups in the amido-methylol compounds play an important role in the electron displacement. Electron-releasing groups attached to either the amido nitrogen or the carbonyl carbon facilitate acid hydrolysis; electron-attracting groups hinder hydrolysis. Various hydrolysis mechanisms are considered for explaining the observed inductive and resonance effects. A mechanism wherein initial electrophilic attack is at the ethereal oxygen and fission of the link with cellulose is through carbonium ion formation appears completely satisfactory in explaining the observed facts.

2324. WHY DO ENDS COME DOWN IN SPINNING? (The influence of selected cotton fiber properties and spinning variables on spinning performance) Waters, W. T.; Phillips, Joe; and Fiori, L. A. Textile Inds. 126, (5) 100-106, 123. 1962. (Republished as: "Dei Che Cosa Dipendono le Rotture dei Feli?" Rivista Dell'Industria Cotoniera 16, 560-65. 1962.)

In this investigation of factors affecting end breakage during the spinning of cotton yarns, it was demonstrated, by use of an accelerated spinning test, that: Increases in spinning tension, decreases in spinning twist, and increases in the short fiber content had the greatest deleterious effect on spinning performance in the order listed. Lowering the average fiber fineness of a cotton blend, through the addition of immature, fine fibers, to about 4.0 Micronaire reading and below, had the least effect. Increasing the average fiber fineness of a

cotton blend, through the addition of mature, coarse fibers, above 4.0 Micronaire reading, decreasing fiber strength, and increasing spinning draft, had intermediate effects on spinning performance. Exploratory investigations of the mechanism of end breakage, using high-speed photography, showed that end breakage was caused mostly by fiber slippage rather than by breakage and confirmed that most end breaks occur in the region between the pigtail guides and the front rolls.

2325. ESTIMATED COSTS AND IN-SERVICE EVALUATIONS OF CHEMICALLY MODIFIED COTTON FABRICS. Decossas, K. M.; Vix, H. L. E.; and Patton, E. L. Am. Dyestuff Reprtr. 51, 318-22. 1962.

Estimated processing costs are reported for the application to cotton in hypothetical plants of new chemical finishes developed at the Southern Regional Research Laboratory. Costs are those for finishing cotton fabric with formic acid colloid of methylolmelamine to impart wrinkle- and muss-resistance, with APO-THPC resin for flame resistance, with silicone alloy for water repellency, and with triazone dissolved in silicone alloy for crease resistance in addition to water repellency imparted by the alloy alone. The magnitude of the markets for materials possessing the quality improvements imparted by these finishes is given. Results show these finishes can be applied for only a few cents per square yard. In addition, they are considered promising because of their ready application in the usual equipment for resin finishing. Findings are included on in-service fabric evaluations in a variety of applications, made recently and/or in progress on acid-formaldehyde-treated cotton fabric, cotton fabrics finished with ethyl triazone, a mixture of ethyl triazone and polyglycol acetal, triazine, and APC, all for imparting wrinkle-resistance; and on APO-THPC resin-treated fabrics for flame resistance.

2326. WHERE RINGLESS SPINNING STANDS TODAY. Kyame, G. J.; and Copeland, H. R. Textile World 112, (5) 70-73. 1962. (Republished as "The S.R. R.L. Ringless Device Progress Report on Radically New Method of Yarn Production." Textile Weekly 62 (2) 549-51. 1962. Also, Rivista Dell'Industria Cotoniera 16, 485-87. 1962.)

A new method for spinning cotton yarns without using rings, travelers, pots, etc., is described. A semi-developed machine has been constructed and test yarns made for comparison with similar yarns made on conventional equipment. The data presented show the experimental yarns to be inferior to the conventional yarns, thereby indicating the need for further improvement in machine performance. The purpose of this paper is to call the attention of industry and other research organizations to this new development.



2327. THE EFFECTS OF CONSTANT SPINDLE AND FRONT ROLL SPEEDS ON THE TWIST-STRENGTH-ELONGATION CHARACTERISTICS OF SINGLE COTTON YARNS. Fiori, L. A.; Louis, G. L.; Leitz, L. A.; and Tallant, J. D. Textile Bull. 38, (5) 50-53. 1962.

Twist-strength and twist-elongation curves are useful in evaluating the characteristics of single yarns. Basically, there are two ways to obtain a series of the same size yarns with varying twists; viz., keeping the spindle speed constant while changing the front roll speeds and keeping the front roll speed constant while changing the spindle speed. This investigation indicated that the level of maximum yarn strength obtained for a given cotton sample depends on whether one uses constant spindle speed or constant front roll speed. Also, constant spindle speed method seemed to yield more erratic yarn strength data than the constant front roll speed method. The trend of yarn elongation values are similar for both methods provided excessive yarn tension is not used in connection with the constant front roll method. Therefore, it is important that specifications should be given as to the method used in spinning when presenting twist-strength and twist-elongation yarn data.

2329. EFFECT OF RESINS AND RUBBER LATICES ON THE PROPERTIES OF UNMODIFIED AND MODIFIED COTTON FABRICS (3 Parts)  
Olson, E. S.; Langston, J. H.; and Rainey, W. T., Jr.  
Contractor: Textile Research Department of Clemson College; Textile Research Department Publication, School of Textiles, Clemson College, Clemson, S. C., 102 pages. 1962.

Part I concerns the study of 83 selected resin and rubber latices. These latices were applied to cotton fabric in an attempt to improve the qualities of stability to ultraviolet light, crease recovery, resistance to abrasion, tear resistance, breaking strength, resistance to microbiological attack, and fabric shrinkage control. Certain latices greatly improved some of the properties such as breaking strength or tear resistance, but this was usually at the expense of some other property such as crease recovery or abrasion resistance. Other latices indicated appreciable improvement in the latter but performed poorly in the former properties. No single latex was found to produce all of the desired improvements. In the second part of the study, which concerned the application of 25 resin and rubber latices to four chemically-modified cotton fabrics, the findings of the first part were substantiated - no one latex improved all properties of the fabric. The properties tested were the same as those of Part I. Also, while one latex improved a given property on one chemically-modified cotton fabric, this same property was deteriorated on another. As a whole, abrasion resistance and breaking strengths were generally improved, whereas crease recoveries and tear

strengths were degraded. A marked degree of shrinkage control was imparted to each fabric by separate latices. Resistance to microbiological attack was vastly improved on all fabrics by one resin, the epoxide. The aminized and allyl fabrics were greatly improved in resistance to microbiological attack by several latices. The third part of the study concerned the application of twelve selected resin and rubber latices to a cotton fabric and two resin and rubber latices to four chemically-modified cotton fabrics. These applications were designed to apply the resin and rubber latices together with selected resins in a single bath to the cotton fabrics. The physical properties tested in addition to those tested in Parts I and II were chlorine retention and resistance to flaming. The findings of the first and second parts were substantiated--no latex improved all tested properties of the fabric. It was further determined that the effects of the latex and resin were not additive. It did not follow that as a given property was improved through the application of the individual latex and resin that a commensurate improvement followed by the application of the mixture of the two. Through selection of an appropriate combination of resin or rubber latex with a given resin, selected properties are improved. APO in combination with a given resin or rubber latex usually improves resistance to flaming.

2330. WASH-WEAR FINISHING OF COTTON FABRICS USING DEFERRED CURING.

Kullman, R. M. H.; Reinhardt, R. M.; Fenner, T. W.; and  
Reid, J. D. Am. Dyestuff Reprtr. 51, P365-P372. 1962.

Deferred curing of cotton fabrics impregnated with crosslinking agent and catalyst offers a potentially valuable and interesting process for the preparation of wash-wear textile products with durable creases. Cotton yarn goods can be impregnated with the finishing agent and catalyst and dried at a relatively low temperature, sufficient to remove water but below a temperature which would cause substantial crosslinking. The fabrics so treated can be cut and sewed into garments, pressed to introduce creases and smooth areas where desired, and then cured to complete the crosslinkage of the cellulose while the garments are in the desired shape. The crease, as well as the smooth-drying characteristics, are thus durably fixed in the garment through chemical reaction. Various finishing agents and catalysts have been examined for use in the deferred-cure process, and the variable of the process studied. A new finishing agent, dimethylol ethyl carbamate, offers promise for commercial application of deferred curing over agents previously available. Fundamental and practical aspects of the process have been considered.



2333. KING COTTON 'STRETCHES' TO EXTEND REIGN. Fisher, C. H. Daily News Record 99, 33. May 21, 1962. [No reprints available].

A brief, non-technical report of research of the Southern Division leading to the development of all-cotton stretch yarns and fabrics. Included is a brief estimate as to the market potential for these new products.

2334. PUBLICATIONS REPORTING RESEARCH AT THE SOUTHERN REGIONAL RESEARCH LABORATORY FOR THE YEARS 1960 AND 1961 ON THE UTILIZATION OF COTTON. (Compiled by M. A. Jones and C. P. Duffy). U. S. Dept. Agr., Agr. Res. Service, Sou. Util. Res. and Dev. Div. 1962.

An abstract bibliography of publications and patents reporting research by the Southern Utilization Research and Development Division on the utilization of cotton. It covers the period January 1960 through December 1961.

2337. CROSS-LINKING COTTON IN THE PERIPHERAL REGIONS OF THE FIBER. Frick, J. G., Jr.; Pierce, A. G., Jr.; and Tripp, V. W. Textile Research J. 32, 425-26. 1962.

Treatment of cotton fabric with formaldehyde in a solution of sulfuric acid, acetic acid, and water causes a rapid, cross-linking reaction that occurs preferentially in the peripheral regions of the cotton fibers. This preferential reaction is apparently a result of a combination of rapid reaction rate and slow penetration of the reactant solution. This treatment is less effective in producing wrinkle resistance than treatments that give more uniformly distributed crosslinks.

2338. USE OF THE IMMERSION TECHNIQUE FOR MEASURING THE VOLUME OF COTTON YARN PACKAGES. Tallant, J. D.; Groves, N. H.; and Fiori, L. A. Textile Research J. 32, 432. 1962.

A simple technique is described for determining the volume of the cotton package on the bobbin by use of the immersion technique. Combining the volume so determined with the weight of cotton in the package apparent yarn package densities may be determined. It was found that package densities increased with spindle speed, traveler weight, and increases in twist. The method seems to give a good measure of the relative spinning tensions with inexpensive apparatus.

2340. CREASE RESISTANT AND WATER REPELLENT COTTON FROM DIMETHYLOL-ETHYLENEUREA-POLYSILOXANE EMULSION TREATMENT. Beninate, J. V.; Drake, G. L., Jr.; and Guthrie, J. D. Am. Dyestuff Reprtr. 51, 394-98. 1962.

Crease resistance and water repellency are imparted to cotton fabrics by the application of an emulsion containing dimethylol-ethyleneurea, a polysiloxane, and catalytic quantities of zinc

nitrate and zirconium acetate. Commercially available siloxane fluids used in the process are methyl hydrogen siloxane (MHS) and a mixture of methyl hydrogen siloxane and dimethyl siloxane (MHS-DMS). The processing procedure consists of padding fabric through the aqueous emulsion, drying the fabric, curing it at about 140°C. for four minutes, and then rinsing to remove any unpolymerized material. About 8% resin add-on is adequate to impart excellent crease resistance and water repellency to 80 x 80 print cloth and 5.5-oz. poplin. These properties are retained after 15 home launderings with synthetic detergents, and after boiling in alkaline soap solution for 2.5 hours. Strength losses of the treated fabrics are comparable to those of other wash-wear finishes. The treated fabrics possess excellent hand before and after repeated laundering.

2342. COTTON SHEETING. WHAT FIBER FINENESS CAN DO TO IT. (Effect of cotton fiber fineness on physical properties of a Type 128 sheeting. Part I. Effect on warp and filling contraction of grey fabrics). Sands, J. E.; Little, H. W.; and Fiori, L. A.; Mathews, W. T., Jr.; Mayne, S. C., Jr.; and Berkley, E. E. Textile Inds. 126, (6) 74-77, 79, 82, 85, 89, 91. 1962.

Since cotton fiber maturity and fineness (estimated from Micronaire readings) are highly correlated in American Upland cottons, the cottons used in this investigation were selected on the basis of their Micronaire readings, which were as follows: 2.5, 3.0, 4.0, 5.0, and 6.0. Only the 3.0, 4.0, and 5.0 cottons were used to spin 21/1 (28 tex), 4.2 TM warp yarns; while all were used to spin 23/1 (26 tex) filling yarns with twist multipliers of 3.6, 4.2, and 4.8 for weaving a Type 128 sheeting. The filling yarns were introduced randomly into the warps under both a "standard" and an "adjusted" tension setting on the preventer spring collar substitute. Fabric width increased as the Micronaire reading of cottons used in filling yarns increased, and as filling twist increased. However, the differences in fabric width--from the desired width of 36 inches--were approximately within commercial tolerances. Warp yarn crimp was only slightly affected by changes in Micronaire reading of cottons and twist used to spin filling yarns. Micronaire reading of cotton used to spin warp yarns affected only warp yarn crimp when the fabrics were woven with the "adjusted" tension setting.

2343. A REPORT: SECOND ANNUAL JOINT CONFERENCE ON CANVAS RESEARCH. Duncan, B. H., II; Brysson, R. J.; and Persell, R. M. Canvas Prods. Rev. 38, (2) 35, 46-47, 64. 1962.

The three-party cooperative research program among the Canvas Products Association International, the Southern Utilization Research and Development Division (USDA), and the Foundation for Cotton Research and Education (an affiliate of the National Cotton Council) is described



and a report covering the second joint meeting of the Canvas Products Advisory Committee and the Technical Advisory Group for Canvas Goods presented. Also presented, is a summary of recommendations by the Committee for future research on outdoor fabrics.

2345. SOME EFFECTS RUBBER AND RESIN LATICES IMPART TO CHEMICALLY MODIFIED AND UNMODIFIED COTTON FABRIC. Olson, E. S.; Langston, J. E.; and Rainey, W. T., Jr. Contractor: Textile Research Department, Clemson College, Clemson, S. C. Am. Dyestuff Reprtr. 51, 351-54. 1962.

This article is a condensation of the findings resulting from application of selected resin and rubber latices to certain cotton fabrics. The complete three-part report may be secured by request from the Textile Research Department, School of Textiles, Clemson, College, Clemson, S. C., or Southern Utilization Research and Development Division, P. O. Box 19687, New Orleans 19, La.

2348. AMIDE-GLYOXAL REACTION PRODUCTS. Vail, S. L.; Moran, C. M.; Moore, H. B.; and Kullman, R. M. H. J. Org. Chem. 27, 2071-74. 1962.

Various bisamides of the type  $RCONH-X-NHCOR$ , where  $R=H$  or  $CH_3$  and  $X=alkylene$  or substituted alkylene, have been treated with glyoxal to produce, in some cases, the desired cyclic compounds. In addition, some reactions of these new compounds have been studied. The synthesis of four new compounds is reported.

2349. EXTENT OF FORMALDEHYDE REACTION WITH SELECTED AMIDES. Vail, S. L.; Moran, C. M.; and Moore, H. B. J. Org. Chem. 27, 2067-70. 1962.

Various formamides and acetamides of the general structures  $RCONH_2$ ,  $RCONHR'$ , and  $RCONH-X-NHCOR$ , where  $X=alkylene$  or substituted alkylene, were treated with an excess of formaldehyde to produce the N-methylol derivatives. The extent of the reaction was determined by titration of the unchanged formaldehyde. Contrary to previous reports, methylation of N-substituted amides goes to 50-100% of completion in many of the cases studied. Methylation is more nearly complete with the bisformamides than with the bisacetamides. Five new bisamides were synthesized by the reaction of diamines with esters.

2350. DRYCLEANING OF COTTON FABRIC. Compton, J.; Hubbard, L. R.; and Hart, W. J. Contractor: Institute of Textile Technology, Charlottesville, Va. [Condensed by E. F. Schultz, Jr., and E. M. Kopacz]. U. S. Dept. Agr. ARS 72-26, 42 pages 1962.

A laboratory drycleaning unit was developed similar in operation to commercial units. Test swatches (6 in. x 6 in.) of a single 80 x 80 cotton printcloth were soiled uniformly with the single nongreasy,

water insoluble soil, lamp black. These were drycleaned together with similar but unsoiled swatches to determine the amount of soil removed from soiled swatches and redeposited on clean swatches. Degree of soiling was measured as percent light reflectance. The theory of soil measuring is discussed and percent soil removal as estimated from fabric reflectance values was computed and compared with similar values from the same fabrics prepared as chopped fiber pads to eliminate orthonogonal nonuniformity of soiling. For comparisons in the interesting range of soil removal, and especially for comparisons within a single detergency system, it is suggested that the comparison of percent soil removal values calculated with the Bacon and Smith equation from the K/S values as computed by the Kubelka-Munk relation from fabric reflectance percentages is a valid procedure.

2351. PREPARATION AND EVALUATION OF SELECTED ALIPHATIC ACID ESTERS OF COTTON FABRIC. Cruz-Lagrange, M. D.; Hamalainen, C.; and Cooper, A. S., Jr. Am. Dyestuff Repts. 51, 428-30. 1962.

Eight different partial esters of cellulose in fabric form, having approximately the same acyl content, were prepared by the trifluoroacetic anhydride impellent procedure, and have been evaluated. As molecular weight of the ester group increased breaking strength, tear strength, abrasion resistance, elongation, and air permeability tended to decrease. Wet wrinkle recovery was increased, while dry recovery was either unchanged or reduced. Some of the ester samples exhibited an appreciable degree of heat-setting capacity in that sharp creases pressed into the fabrics were retained through several launderings. This feature could be used to advantage in apparel applications such as in the formation of the pleats and in shaping fabrics.

2353. YARN AND FABRIC PROPERTIES AND PROCESSING PERFORMANCE OF COTTON TREATED WITH A CROSS-LINKING RESIN. Ruppenicker, G. F., Jr.; Brown, J. J.; and Hoffman, M. J. Textile Research J. 32, 516-21. 1962.

The general processing performance in the cotton processing system of cotton containing various percentages of fibers treated with dimethylol ethyleneurea, and the properties of the resultant yarns and fabrics were investigated. The resin-treated cotton was evaluated in 100% form and in blends with scoured cotton. Fabrics woven with filling yarns spun from the 100% treated cotton and the blends, using a common untreated warp, were evaluated for warmth properties in terms of thickness, bulk density, and air permeability. Difficulties were experienced in processing cotton with large percentages of resin-treated fibers due mainly to uneven drafting and the formation of static charges during the carding and drawing operations. Yarns spun from cotton containing resin-treated fibers



were progressively weaker, less uniform, and more degraded in appearance as the percentage of resin-treated fibers was increased. Yarn elongation-at-break decreased with the addition of resin-treated fibers, but elongation at loads below the breaking point increased, indicating a relationship between yarn elongation at low loads and yarn bulk. Although experimental fabrics having improved warmth properties were made from yarns composed of 50% or more resin-treated fibers, it was concluded that, with present knowledge, the lower yarn quality and the poor processing performance would make production difficult on a commercial scale.

2354. EXTENT OF HYDROLYSIS OF FORMALDEHYDE TREATED COTTON. Arceneaux, R. L.; and Fujimoto, R. A. Textile Research J. 32, 521-22. 1962.

Radioactive formaldehyde was reacted with cotton by three methods and the resulting products hydrolyzed by 12 N sulfuric acid at room temperature for 17 hours. Examination of the residue for radioactive carbon and analyses of the hydrolysate by the chromotropic acid method showed that 91 to 95% of the formaldehyde was recovered and these results were closely comparable to those obtained by the more complicated usual distillation procedure.

2355. THE TREATMENT OF COTTON WITH FORMALDEHYDE IN CALCIUM CHLORIDE SOLUTIONS. Chance, L. H.; Leonard, E. K.; and Reeves, W. A. Textile Research J. 32, 481-88. 1962.

Cotton print cloth and broadcloth were crosslinked by soaking in aqueous solutions containing calcium chloride, hydrochloric acid, and formaldehyde. The calcium chloride concentration was varied to study the effect it would have on the rate at which combined formaldehyde content and wet and dry wrinkle recovery were obtained. Striking differences were observed between 10% and 50% calcium chloride. Thirty-five percent calcium chloride solutions were found to be best. A typical laboratory procedure consisted in soaking the fabric samples at room temperature (28°-30°C.) in a solution containing 35%  $\text{CaCl}_2$ , 3.7%  $\text{HCl}$ , and 7.2%  $\text{HCHO}$  for the required length of time. Samples treated in this manner contained about 0.7% to 0.9%  $\text{HCHO}$  and had good wet and dry wrinkle recovery. The effect of time, temperature, and  $\text{HCl}$  and  $\text{HCHO}$  concentrations on reaction rates, combined  $\text{HCHO}$  content, and physical properties was also studied. Tearing strength and breaking strength retentions were in the range of 50-70%.

2356. HYDROLYSIS RESISTANCE OF CROSS-LINKING FINISHES FOR COTTON.  
Andrews, B. A. K.; Arceneaux, R. L.; Frick, J. G., Jr.;  
and Reid, J. D. Textile Research J. 32, 489-96. 1962.

The relative acid and alkali stabilities of various nitrogenous finishes for cotton have been compared. The effect the groups attached to the carbonyl and the substituents on the amido nitrogen exert on the electron density of the amido group has been related to acid and alkali resistance. The finishes studied included those derived from urea, cyclic ureas, carbamates, and carboxylic amides. In general, the groups exerting strong electron-attracting force on the amido group will increase the acid stability of the finish and decrease the alkali resistance. The groups which are strong electron donors increase the alkali stability and decrease the acid resistance.

2357. APPLICATION OF A GENERAL SPECTROCHEMICAL METHOD FOR THE ANALYSIS OF PLANT PRODUCTS TO THE DETERMINATION OF TRACE METALS IN COTTON AND MODIFIED COTTON FIBERS AND FABRICS.  
O'Connor, R. T.; Heinzelman, D. C.; and Piccolo, B.  
Am. Dyestuff Reprtr. 51, 466-70. 1962.

Chemical modification and finishing of cellulose for specific end-uses has resulted in the appearance of cotton materials containing added metals and nonmetallic elements. Among such treatments are, for example, the use of organo-metallic compounds such as the copper complex copper-8-quinolinolate for resistance to weather exposure and mildew inhibition; chromium complexes of perfluorooctanoic acid to impart water and oil repellency; etc. Other examples include treatments with metallic oxides or inorganic salts such as lead chromate to decrease actinic degradation, as in tobacco shade cloth; cobaltous metaborate or hydroxide to increase resistance to weathering and microorganisms; or bis-(tributyltin) oxide, used as a mildew inhibitor. Still another group of reagents for treating cotton includes the resins, which often impart a metal such as antimony or titanium, to the fabric, or phosphorus for flame resistance, etc. Frequently it is desirable to ascertain how a particular fabric has been modified or the extent to which it has been treated. Often, too, in the research laboratory, it is desirable to determine whether a certain reaction has proceeded as expected, to ascertain the character and extent of the add-on. In the case of these metal-containing reagents, the required data could easily be calculated if a simple, rapid and reliable method for the identification of the metals present and for their determination with sufficient accuracy were available. At the Southern Regional Research Laboratory a general technique for the spectrochemical analysis of all plant products has been found to be quite adequate for these purposes. The principles of this method are reviewed briefly and several examples of its application to the identification and quantitative determination of various metals found in chemically-treated cottons are presented.



2358. THERMAL X-RAY DIFFRACTION STUDY OF HIGHLY ACETYLATED COTTON CELLULOSE. Conrad, C. M.; and Creely, J. J. J. Polymer Sci. 58, 781-90. 1962.

Cotton cellulose in the form of scoured yarn was acetylated at 15° C. in a mixture of isopropyl acetate and acetic anhydride in the presence of perchloric acid catalyst to various degrees from 1.1 to 2.9 acetyl groups per anhydroglucose unit. For comparative purposes some of the yarn was acetylated at 20° C. by a more conventional method with a 3:1 mixture of acetic acid and acetic anhydride, also with perchloric acid as catalyst. The products were studied by x-ray diffraction, both at room temperature and, with the aid of a specially-controlled diffractometer furnace, at elevated temperatures. Diffractograms of the products show that as acetylation proceeds, the crystal structure of native cellulose disappears progressively until at a substitution of 2.93 acetyls per anhydroglucose unit it is nearly all gone. Examination with the diffractometer furnace shows in an impressive way the acetyl content and temperature at which cellulose acetate first begins to crystallize, the progressive increase in crystallizable acetate as acetylation proceeds, the temperature range over which the crystal structure is stable, the temperature at which it melts, and finally the temperature at which the acetate eventually carbonizes.

2359. PROBLEMS IN RELATING COTTON FIBER AND PROCESSING VARIABLES TO END BREAKAGE IN SPINNING. Fiori, L. A.; Louis, G. L.; and Tallant, J. D. Am. Soc. Quality Control Ann. Conv. Trans. 16, 515-22. 1962. (Republished, Textile Bull. 88, (9) 86, 88-91. 1962).

The problems encountered in relating fiber properties and processing variables to spinning efficiency are presented, including a discussion of bases for measuring spinning efficiency. Past research has defined fairly well the relationships between fiber properties and yarn properties. Progress has been difficult in relating cotton fiber properties and processing variables to spinning efficiency because of lack of rapid and reliable means of obtaining the large amounts of end breakage data in spinning for statistical analyses. Two procedures, the SRRL Accelerated Spinning Test and the 720-Spindle-Hour Test, recently developed by this Laboratory for measuring the effect of fiber properties and processing variables on spinning performance are discussed.

PATENTS

2360. WRINKLE RESISTANT CELLULOSIC TEXTILES AND METHOD OF PRODUCTION. U. S. Pat. No. 3,015,583, January 2, 1962. Vail, S. L.; Frick, J. G., Jr.; and Reid, J. D.

A method for preparing N-alkylmelamines. These materials upon reaction with formaldehyde produce water soluble methylolmelamines that have outstanding characteristics as treating agents for cellulosic textiles. The new N-alkylmelamines prepared according to the process of this invention confer increased resiliency and wrinkle resistance upon the fabrics to which they are applied. The finished fabrics are able to stand repeated laundering and the treated fabrics resist hypochlorite damage.

2361. WRINKLE RESISTANCE TREATMENT FOR CELLULOSIC TEXTILE FABRICS U. S. Pat. No. 3,015,584, January 2, 1962. Reinhardt, R. M.; Frick, J. G., Jr.; Arceneaux, R. L.; and Reid, J. D.

A wrinkle resistant treatment for cellulosic textile fabrics which is immune to damage from hypochlorite bleaching agents. The resin treatment employs dimethylol ethyleneurea and a polymeric acetal formed from formaldehyde and a polyhydroxy compound.

2362. CELLULOSE DERIVATIVE AND METHOD OF PREPARING SAME. U. S. Pat. No. 3,017,237, January 16, 1962. Bullock, A. L.; and Guthrie, J. D.

A cellulosic derivative containing both crosslinks between cellulose chains and free reactive carboxyl groups which is soluble and highly resistant to swelling. The cellulose derivative may be prepared from either granular or fibrous cellulose from yarn or from fabrics. The derivative is useful as an ion exchange medium.

2364. WRINKLE RESISTANT TREATMENT FOR CELLULOSIC TEXTILE MATERIALS. U. S. Pat. No. 3,028,264, April 3, 1962. Frick, J. G., Jr.

A wrinkle resistant treatment for cellulosic textile materials which consist of treating the fabric with the monomeric reaction product of cyanuric acid and formaldehyde and heat curing the treated material.



2366. OIL- AND WATER-RESISTANT FABRICS AND METHOD FOR THEIR PRODUCTION. U. S. Pat. No. 3,031,335, April 24, 1962. Segal, L.; and Clayton, R. L., Jr.

A process for rendering fabrics resistant to soil, grease, oil, and water-borne stains. The patented process involves a two-step operation wherein the fabric is first immersed in an inorganic salt solution and subsequently treated with a perfluoro acid.

2370. WRINKLE RESISTANT CELLULOSE TEXTILES AND PROCESSES FOR PRODUCING SAME. U. S. Pat. No. 3,038,776, June 12, 1962. Chance, L. H.; and Reeves, W. A.

The process for treating cotton textiles to render them rot, crease and shrink resistant. The process involves impregnating the cotton textile with an aqueous solution of a monomeric carbonylbisaziridine compound, either carbonylbisaziridine or carbonylbis(2-methylaziridine).

2372. CURING SWOLLEN COTTON AT HIGH TEMPERATURE. Valko, E. I.; and Limdi, Kunjvihar. CONTRACTOR: Lowell Technological Institute Research Foundation, Lowell, Mass. Textile Research J. 32, 331-37. 1962.

Dimethylol ethylene urea was applied to cotton in aqueous solutions containing high concentrations of nonvolatile, nonreactive, water-soluble compounds. The fiber appears to remain in the distended state after evaporation of water, and the fabric cured at high temperature exhibits wet but low dry wrinkle recovery properties similar to those previously observed in cotton crosslinked in the wet state. Moisture regain and water of imbibition are maintained at high level in the cotton fiber crosslinked by the new process. Premercerization without intervening drying enhances these effects. The application of the new technique for other purposes, including the introduction of water-insoluble finishing agents inside cotton fibers, is suggested.

2373. IMPARTING WRINKLE RESISTANCE TO COTTON FABRICS WITH VAPOR FROM HCL-PARAFORMALDEHYDE. Guthrie, J. D. Am. Dyestuff Reprtr. 51, 507-12. 1962.

A dust, made by exposing paraformaldehyde powder to vapor from concentrated hydrochloric acid, was found useful for imparting wrinkle resistance to cotton fabrics. The method consisted of exposing fabric in the same container as the dust, but without direct contact with it. Cotton fabrics, completed garments, handkerchiefs, and other materials, including sliver, yarn, cotton rug material, and noncotton fabrics were treated in this way for 20 to 30 hours at room temperature in a polyethylene barrel. Cotton fabrics, wrinkle recovery angles of about 270° W+F were obtained in cotton fabrics at about 0.2% formaldehyde content, with a breaking strength loss of about 40%. A formaldehyde content of about 0.11% gave significant increases in wrinkle recovery angles. Formaldehyde content did not decrease significantly after 20 launderings, but the wash-wear ratings of four fell to three. The treated cotton fabrics showed marked dye resistance, and less water imbibition, but retained soil somewhat more readily than control fabrics. Treated shirts were good at first in wash-wear properties, but required some ironing after about ten launderings.

2374. DRYING, CLEANING EFFECTS ON COTTON FIBER PROPERTIES. Grant, J. N.; Honold, Edith; Andrews, F. R.; and Griffin, A. C. Cotton Gin & Oil Mill Press 63, (15), 7, 46-47. 1962.

The removal of moisture from cotton by heat increases the efficiency of the cleaning processes but alters certain properties of the fibers. Damage, including breakage and cell wall abrasion, are discussed in relation to several processes at the gin and in the textile mill. Other properties, such as temperature gradient in drying, fiber strength, moisture regain, density and dyeing are discussed in relation to the extent of heat drying and mechanical processes.



2376. REACTION OF 1-NAPHTHYL ISOCYANATE WITH 3-HYDROXYMETHYL-3-METHOXYMETHYL-2-BUTANONE. A REINVESTIGATION. Ellzey, S. E., Jr.; and Mack, C. H. J. Org. Chem. 27, 2655-56. 1962.

3-Hydroxymethyl-3-methoxymethyl-2-butanone and 1-naphthyl isocyanate were previously reported to form a "diurethane." Near infrared and infrared data have been used to show that the product is actually an allophanate. The spectral data was supported by chemical evidence.

2378. KINETICS OF THE OXIDATION OF COTTON WITH HYPOCHLORITE IN THE pH RANGE 5-10 [PL-480 GRANT]. Epstein, J. A.; and Lewin, Menachem (Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry, Jerusalem, Israel). J. Polymer Sci. 58, 991-1008. 1962.

The rate of consumption of oxygen by cotton and cotton cellulose from solutions of hypochlorite in the pH range 5 to 10 has been studied. Kinetic plots were obtained either by periodically titrating aliquots or by automatically recording the amount of alkali required to keep the pH constant. In the case of pure cotton cellulose the plots are linear, whereas in the case of cotton the plots consist of two parts, an initial, rapid oxidation of the impurities followed by a slower, linear oxidation of the cellulose. The dependence of the rate of oxidation on the pH may be expressed by:

$$-dc/dt = kc^2HOClc^{1/2}ClO-$$

which also accounts for the dependence of the rate on the initial concentration of oxidant. A mechanism is suggested in terms of the free-radical OH and  $Cl_2OOH$ .

2379. FUNCTIONAL GROUPS AND DEGRADATION OF COTTON OXIDIZED BY HYPOCHLORITE [PL-480 GRANT]. Lewin, Menachem; and Epstein, J. A. (Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry, Jerusalem, Israel). J. Polymer Sci. 58, 1023-37. 1962.

Functional groups and degradation of cotton oxidized by hypochlorite at several pH values in the range 5 to 10 were studied. The carboxyl group content of the oxidized cottons increases, while the aldehyde and ketone group contents decrease with increase in pH. Approximately 40% of the oxidant consumed is accounted for by the functional groups at all pH values. The ratio of carboxyl, aldehyde, and ketone groups formed per scission is 1-1.5:3:3.5 at the acidic pH range and 5:0.8:0.0 at pH 10. Oxygen consumption per scission is 26 atoms, out of which 10.4 atoms are accounted for by the functional groups. The rest of the oxygen is explained by oxidation of the soluble products of the short chain material in the fiber phase and by the

functional groups of the short chains with D.P. up to 37. The degradation was found to be random at the whole pH range studied, as proved by the ratio of the number-average and weight-average molecular weights and by the linearity of the plot of  $\log \frac{1}{n}$  vs.  $\log (O_c + O_{co})$  where  $O_c$  is the oxygen consumed and  $O_{co}$  a constant. It is suggested that the degradation and oxidation reactions occur simultaneously and, at a given pH, with similar rates, so that all carbon atoms of an anhydroglucose unit in all chains of the amorphous phase will have a similar probability of being attacked.

2384. **CROSSLINKING OF COTTON WITH GASEOUS FORMALDEHYDE.** Arceneaux, R. L.; Fujimoto, R. A.; Reid, J. D.; and Reinhardt, R. M. Am. Dyestuff Reprtr. 51, P559-P566. 1962.

The crosslinking of cotton cellulose by treatment with gaseous formaldehyde in the presence of hydrogen chloride as catalyst produces fabric with improved wrinkle resistance and wash-wear properties. Time and temperature of treatment, concentration of catalyst, and moisture content of the cotton have been varied while employing an atmosphere of formaldehyde in air for the reaction. Both mercerized and modified cotton print cloth were treated. Wet and dry (conditioned) crease-recovery angles, wash-wear ratings, breaking strengths, elongations, moisture regains, and bound formaldehyde contents of the treated fabrics were determined.

2385. **INFLUENCE OF SOLVENT MEDIA UPON POLYMERIZATION OF A SILICONE ALLOY WATER REPELLENT.** Conner, C. J.; Mazzeno, L. W., Jr.; and Reeves, W. A. Textile Research J. 32, 598-600. 1962.

A silicone-alloy, water-repellent finish was made by the simultaneous polymerization of tetravinyl silane and methyl hydrogen siloxane carried out in four different solvents. The rate of polymerization was greater in two ketone solvents than in two hydrocarbons. The quality of the alloy as a water repellent also was affected by the solvent in which it was prepared.

2386. **COMPARISON OF THE COMBING AND CUTTING RATIOS AS AN INDICATION OF FIBER ARRANGEMENT.** Simpson, Jack. Textile Research J. 32, 614-15. 1962.

The cutting ratio of the Lindsley method is a more sensitive indicator of fiber arrangement, especially fiber hooked ends, than the combing ratio. This was shown in one instance by comparison of the cutting and combing ratios with the actual incidence of fiber hooked ends obtained with the tracer fiber technique. In some cases the values of the combing ratio in the forward and reverse direction was opposite to what would be expected from the knowledge of fiber hooked ends. This was never experienced with the cutting ratio.



2387. NEW TEST FABRIC FOR TENSILE DETERMINATIONS. Brysson, R. J.; and Marhezich, A. R. Textile Research J. 32, 615-16. 1962.

A new test fabric for tensile determinations that allows more rapid and accurate sample preparation is described and the advantages of using spaced double warp threads over other methods of setting off a predetermined number of threads is pointed out. Data are presented to illustrate the time savings resulting from the use of the new test fabric.

2388. SHORT FIBERS IN COTTON (A reply to Dr. V. B. Merchant's letter) Tallant, J. D.; and Fiori, L. A. Textile Research J. 32, 610-11. 1962.

Evidence is presented that the 3/16-inch tip at each end of cotton fibers is "ineffective" in contributing to yarn strength, and that this was true for a wide range of yarn numbers and twists spun from a range of staple length cottons.

2390. TEXTURED COTTON YARNS (Now--durable stretch and bulky cotton yarns are produced through mechanical and chemical treatments) Brown, J. J.; and Ruppenicker, G. F., Jr. Textile Inds. 126, (8) 103-11. 1962. (Republished as: "Getextureerde Katoenen Garens; De Vervaardiging Van Permanent Elastische Katoenen Garens Door Middel Van Chemische en Mechanische Behandelingen." De Tex 21, 847-57. 1962).

Bulky, highly-stretchable, textured cotton yarns having a total elongation of approximately 400 percent were produced by treating highly-twisted plied yarns with a crosslinking resin, curing them in this highly twisted state, and then backtwisting. Although yarn strength decreased approximately 50 percent because of the chemical and mechanical treatments, there were no difficulties in winding, warping, and weaving. Experimental fabrics having up to 80 percent elongation-at-break were woven from the textured cotton yarns. Loosely-woven constructions were used to allow the textured yarns room to contract. Fabric stretch was controlled by adjusting the thread count but was also affected by the interlacing of the ends and picks. The highly-stretchable fabrics had good recovery from short-term deformation. Those held in an extended position for longer periods of time were restored by wetting-out. The experimental fabrics were also thicker, lower in bulk density, less permeable to airflow, and better thermal insulators than comparable fabrics woven from untreated control yarns. Although breaking strengths of the experimental fabrics were, in some cases, over 50 percent lower than those of fabrics woven from untreated yarns, abrasion resistance was greater.

2391. THE TREATMENT OF COTTON WITH FORMALDEHYDE IN ACETIC ACID, ACETONE, AND DIOXANE SOLUTIONS. Chance, L. H.; Perkins, R. M.; and Reeves, W. A. Am. Dyestuff Reprtr. 51, 583-87. 1962.

The reaction of cotton fabric in a wet, partially swollen condition in a solution of acetic acid, water, formaldehyde, and aluminum chloride or zinc fluoborate is described. Aluminum chloride was effective as a catalyst, but the reaction rate was much slower than when hydrochloric acid was used as a catalyst. Little or no cross-linking occurred in the presence of zinc fluoborate as measured by wrinkle-recovery angles. The reaction of cotton fabric in solutions of acetone or dioxane, water, formaldehyde and hydrochloric acid is also described. The rate at which combined formaldehyde was obtained was less for the dioxane and acetone method than for the acetic acid method. When cotton fabric was pretreated with polyethylene, the rate at which the wrinkle recovery was increased by the acetic acid method (HCl catalyst) was greater than when no pretreatment was used. Data on wrinkle-recovery angles, strength, and combined formaldehyde contents are given on crosslinked fabric samples.

2394. ORIGIN OF SHORT FIBERS IN AMERICAN COTTONS. Grant, J. N.; Tsoi, R. H.; and Barker, H. D. Textile Bull. 38, (8) 42-46. 1962.

The quantity of short fibers in experimentally ginned cotton is related to the variety and the environmental conditions during growth. The environmental effects are considerably greater than the varietal effects. Varieties producing lint of essentially equal staple length may differ in the quantity of short fibers in the ginned lint. Only within a variety are relationships evident between short-fiber content and length, fineness and maturity. Lint removed by hand from the seed has fewer short fibers than that removed by saw gins. The quantity of short fibers in commercially ginned lint is related to the drying and cleaning procedures but the level depends upon factors in addition to those of ginning.

2399. STABILITY OF THE URON RING IN WASH-WEAR FINISHING OF COTTON. Arceneaux, R. L.; and Reid, J. D. I&EC, Product Res. & Develop. 1, 181-84. 1962.

Cotton fabric finished with N,N'-bis(methoxymethyl)uron has good wrinkle-resistance which is durable to repeated launderings. It resists chlorine damage after repeated home-type and high-temperature alkaline launderings. The stability of the uron ring in this agent is greater than that of N-methyl-N'-methoxymethyluron and N,N'-dimethyluron. The latter is unstable under the acid conditions used in the application of crosslinking agents to cotton. An explanation for the cause of this difference is proposed. Properties of cotton fabric treated with pure N,N'-bis(methoxymethyl)uron and with a crude product are given.



2400. THE EFFECT OF SPEED OF DRAFTING, IN TERMS OF SPINDLE SPEED, ON SKEIN BREAKING STRENGTH OF COTTON YARNS SPUN ON THE DOUBLE-APRON SYSTEM [PL-480 GRANT]. Audivert, R.; and Vidiella, J. E. (Patronato "Juan de la Cierva," Seccion Textil, Barcelona, Spain). Textile Research J. 32, 652-57. 1962.

This work was primarily intended to find the effect of speed of drafting, associated with spindle speed, on yarn breaking strength. Yarns were spun from a series of rovings widely different in size, with a series of twist multipliers, and a range of spindle speeds. For the 6000 to 12,000 rpm range their strength increased with increasing spindle speed. At speeds below this range a minimum in strength was found between 4000 and 5000 rpm. Other findings: strength decreased with increase in roving twist above normal values, and thinner rovings gave stronger yarns under the conditions of these experiments.

2401. THE CONTINUOUS MEASUREMENT OF THE CRIMP DIAMETER OF TEXTILE FIBERS [PL-480 GRANT]. Shiloh, Miriam (Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry, Jerusalem, Israel). Textile Research J. 32, 698-99. 1962.

The crimp in cotton fibers under load was expressed as an effective amplitude of the fiber in space, and measured as coordinate in perpendicular planes (x and y) from a straight line (fiber axis). The crimp value depended upon the interval used in measuring the coordinates. A method of continuous tracing of images of fibers was developed. The tracing mechanism was electrically-connected to a transistorized computer which makes the summations needed for calculating mathematical values for expressing the crimp diameter  $D = \sqrt{\sigma_x^2 + \sigma_y^2}$ . The tracer and computing apparatus will be described in a subsequent publication.

2402. AN X-RAY DIFFRACTOMETER SPECIMEN HOLDER FOR WET CELLULOSIC MATERIALS. Segal, Leon. Textile Research J. 32, 702-703. 1962.

A specimen holder for the x-ray diffractometer has been constructed for use with wet samples of cellulosic fibers. Polyethylene film, 0.0005-in. thick, sealed to the holder with silicone high-vacuum grease reduces evaporation of the wetting liquid and protects the sample against atmospheric carbon dioxide and moisture during the scanning period. Of simple design, the holder is milled from a single piece of aluminum. No interferences from the aluminum were found over the range  $2\theta = 4 - 28^\circ$ , and background level was quite low; the polyethylene interference at  $2\theta = 21.3^\circ$  is very weak with 0.0005-in. film. Very good diffractograms were obtained from amine-wet complexes of cellulose with ethylene- and hexamethylenediamines

and from water cellulose, as well as from the dry amine-cellulose complexes. Sharp well-separated interferences in the diffractogram of hexamethylenediamine carbamate suggests its possible use as a goniometer calibrating standard.

2403. A FURTHER STUDY OF HYPOCHLORITE-RESISTANT MELAMINE-TYPE FINISHES. Vail, S. L.; Frick, J. G., Jr.; and Reid, J. D. Am. Dyestuff Rept'r. 51, 622-25. 1962.

Previous work in this field has been expanded to include additional substituted amino-s-triazines, namely: N,N'-tris(2-hydroxyethyl)-melamine; N,N,N',N'-tetrakis(2-hydroxyethyl)melamine; hexakis(2-hydroxyethyl)melamine; and 3-acetyl-3-methylpimeloguanamine. A more thorough understanding of the mechanism of yellowing of melamines and melamine-type finishes from hypochlorite treatment has been sought. Results obtained after chlorination of melamine finishes on fabric have been compared with results obtained from chlorination of the melamines in vitro. Data of a practical nature concerning the use of methylol derivatives from N,N',N''-trimethylmelamine and N,N'-dimethyl-N'',N''-bis(2-hydroxyethyl)melamine in finishing of cotton textiles are also presented.

2404. DETERMINATION OF FACTORS WHICH INFLUENCE THE DRAPING PROPERTIES OF COTTON FABRICS. Chu, C. C.; Hamburger, W. J.; and Platt, M. M. Contractor: Fabric Research Laboratories, Inc., Dedham, Mass. U. S. Dept. Agr., ARS 72-17, 57 pages. 1962.

This research involved a multiplicity of investigations relating to the drape of fabrics, including: (a) subjective evaluation of drape correlated with Drapemeter (an instrument capable of measuring the projected area beneath a circular fabric specimen which has been draped over a circular support) measurements; (b) interpretation of some aspects of the mechanism of draped samples by reference to classical theories of mechanics, principally the flat-plate theory of deformation; (c) evaluation of experimental drape data under a variety of test conditions; (d) examination of the geometry of draped fabrics; (e) discussion of factors influencing the stiffness of fabrics; and (f) measurements of the drapability of cotton fabrics and of a series of fabrics, with systematically varied geometric parameters, produced from cellulose acetate yarns. Some preliminary conclusions are presented concerning the effects of fiber, yarn, fabric geometry, and finishing on fabric drapability. The success of the Drapemeter, and the encouraging results of the preliminary investigation of the effect on drape of variations in geometric parameters led to an additional investigation aimed at improving the draping properties of cotton fabrics by varying yarn and fabric structures and application of selected finishing agents. The results of this work are soon to be published.



2405. COTTON SHEETING. WHEAT FIBER FINENESS CAN DO TO IT. (Effect of cotton fiber fineness on physical properties of a Type 128 sheeting. Part II. Effect of bleaching and dyeing on warp and filling contraction). Sands, J. E.; Little, H. W.; Fiori, L. A.; Groves, N. H.; Mathews, W. T., Jr.; Mayne, S. C., Jr.; and Berkley, E. E. Textile Inds. 126, (9) 110-11, 113-14, 116, 122-23. 1962.

Changes in width and warp yarn crimp of fabrics containing warp and filling yarns spun from cottons having a range of fineness (Micronaire reading) and filling spinning twist, and subsequently, bleached and dyed were investigated. In Part I, on grey fabrics, increases in fabric width were noted with the use of progressively coarser cottons in the filling yarns. In Part II, however, after bleaching and dyeing, significant decreases in fabric width are shown to occur with the use of progressively coarser cottons in the filling yarns and with increasing filling twist. Filling twist was the greatest contributor to warp yarn crimp and was directly related to it.

2406. WRINKLE-RESISTANT COTTON WITH APN. Hobart, S. R.; Drake, G. L., Jr.; and Guthrie, J. D. Amer. Dyestuff Reprtr. 51, 657-61. 1962.

Wrinkle recoveries of approximately 290° (W + F) have been obtained on 80 x 80 cotton print cloth by treatment with a new chemical called APN. This chemical, 2,2,4,4,6,6-hexa-(1-aziridinyl)-2,4,6-triphosphal, 1,3,5-triazine, is applied by the conventional padding, drying, and curing procedure from aqueous solution containing a mildly acidic catalyst. The finish is durable to home laundering. Good fabric properties are retained. However, as with other aziridinyl-type finishes, the fabric is subject to yellowing by chlorine bleaching.

2409. OXIDATION OF PARTIALLY ETHERIFIED COTTONS WITH NITROGEN DIOXIDE. Reinhardt, R. M.; Fenner, T. W.; and Reid, J. D. Textile Research J. 32, 735-42. 1962.

Alkali-soluble, fibrous cellulosic textile materials may be prepared by the oxidation of partially-etherified cottons with nitrogen dioxide. Modified cottons bearing ether substituents, such as aminoethyl, carboxymethyl, carboxyethyl, methyl,  $\alpha$ -methylcarboxymethyl, or phosphonomethyl groups, were readily oxidized to yield products with high alkali solubility. By milder oxidation conditions than those required for native or mercerized cottons, products were prepared that are almost completely soluble in dilute sodium hydroxide or sodium carbonate solutions. The oxidation may be carried out with gaseous nitrogen dioxide or with organic solvent solutions of nitrogen dioxide. Variables of the process and properties of the products were investigated most extensively with partially carboxymethylated cotton.

2414. NEW PROCESSES CAN PAY HANDSOMELY. Rusca, R. A. Daily News Record 201, Sec. 2, 10 (October 15, 1962) [No reprints available].

Current efforts to automate the production of cotton textiles are largely concerned with joining together conventional processing equipment and with mechanical transportation of products between processing stages. While reductions in manufacturing costs are being achieved by this approach, there is need for a broad pioneering research program to obtain new fundamental information that would lead to the development of a completely new system for efficiently processing fibers into textiles. The scope and plan for such a program are outlined, and potential advantages of a new system are cited.

2415. AN ANNOTATED BIBLIOGRAPHY OF COTTON RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION. Jones, M. A. U. S. Dept. Agr., Agr. Res. Service, Misc. Publ. No. 893, 106 pp. 1962.

This publication contains abstracts of all publications reporting research on cotton utilization at the Southern Regional Research Laboratory from its establishment in 1939 through 1959. Approximately 800 technical publications and patents are listed. Cotton utilization research is discussed briefly in a foreword by Dr. C. H. Fisher, Director of the Southern Division. Publications are arranged in broad categories, including fiber studies, chemical treatment and modification, mechanical processing, miscellaneous, and general. These categories are subdivided into appropriate sections, such as wash-wear, flame resistance, machinery, processing organization, and other subtitles. There is an author index, and a subject index with numerous cross references.

2416. NEW TREATMENTS TESTED TO HIKE CANVAS LIFE. [Brysson, R. J.]. Daily News Record 204, 26. 1962. [No reprints available].

This brief article describes outdoor fabric research at the USDA's Southern Division being conducted under the joint research program of the USDA, the National Cotton Council and the Canvas Products Association International. Brief descriptions of related foreign and domestic contractual studies are also included.

2418. IMPROVEMENTS IN THE DIMETHYLOL MONOCARBAMATE WASH-WEAR FINISH. Arceneaux, R. L.; and Reid, J. D. Am. Dyestuff Reprtr. 51, 800-01. 1962. [Technical Topics Section]

Methods of preparing dimethylol ethyl carbamate (DMEC) finishing agent have been improved. The resultant finish is shown to be highly resistant to laundering hazards including bleaching.



2421. S.R.R.I. RESEARCH REPORT: AN EVALUATION OF SEVERAL FACTORS IN FLAT BUNDLE TESTING [Increasing confidence can be placed in bundle load and elongation measurements, study notes]. Weiss, L. C.; Orr, R. S.; Nott, E. E.; and Grant, J. N. Textile Bull. 88, (11) 38-40, 42-44. 1962.

The reliability and reproducibility of tenacity and percent elongation for flat fiber bundles have been investigated. Bundle tenacities for cottons representing wide ranges in fiber properties were tested on the Stelmeter at various clamp spacings. Measurements representing different techniques and different degrees of operator experience were compared. The results showed that differences among operators may be consistent. The importance of lesser known parameters are emphasized. For percent elongation two methods are used to estimate the slip length of fibers in bundle testing. In some cases these yield different values for percent elongation. Effects upon tenacity and percent elongation of slip length, combing and bundle completeness are presented.

2422. DEVELOPMENT OF FUNGICIDES. [Conner, C. J.; and Cooper, A. S., Jr.]. Canvas Prods. Rev. 39, (7) 18, 26. 1962.

Exploratory research on the application of fungicides resulted in a new method for water-solubilizing a large percentage of known phenylmercuric compounds. These water-soluble derivatives or complexes can be applied to cotton fabrics by conventional padding followed by oven curing. The soluble complex breaks down to deposit an insoluble (basic) phenylmercuric-zirconium compound. The procedure offers ease of application in conjunction with good fungicidal activity. A comparative study of soil-burial resistance using the phenylmercuric acetate-zirconium acetate complex and a commercial water-solubilized phenylmercuric acetate indicated the new complex treatment to be equal to, if not slightly better than the commercial product.

2424. COHESION PHENOMENA IN COTTON ROVINGS AND YARNS. PART I: GENERAL STUDY [PL-480 GRANT]. Barella, Alberto; and Sust, Antonio (Patronato "Juan de la Cierva" Seccion Textil, Barcelona, Spain). Textile Research J. 32, 217-26. 1962.

In the present work, cohesion phenomena of a general character are studied in cotton rovings and yarns. The cohesion is expressed as a coefficient of minimum twist of cohesion, and the following are considered throughout the work: (a) influence of testing conditions on the cohesion of rovings and yarns, (b) influence of fiber characteristics on cohesion. Finally on the basis of data of the cohesion test, the strength of cotton rovings is also considered. In this first part of the work, commercial yarns and rovings have been used.

2425. COTTON SHEETING. WHAT FIBER FINENESS CAN DO TO IT.  
(Effect of cotton fiber fineness on physical properties of a type 128 sheeting. Part 3. Effect on the tensile properties and resistance to abrasion and tearing of grey fabrics). Sands, J. E.; Little, H. W.; Fiori, L. A.; Castillon, A. V.; Mathews, W. T., Jr.; Mayne, S. C., Jr.; and Berkley, E. E. Textile Inds. 126, (11) 140-43, 145-48. 1962.

Cottons having a range of fiber fineness (3.0, 4.0, and 5.0 Micronaire reading) were used in warp yarns; and 2.5, 3.0, 4.0, 5.0, and 6.0 in filling yarns, which were spun in three equal groups, each with a different twist multiplier. Fabrics were woven with selected combinations of fiber finenesses in warp and filling yarns and a range of filling twists. The effect of these combinations on such properties as strip and grab breaking strength, elongation-at-break, and resistance to tearing and flex abrasion was evaluated. A significant result is that maximum filling strip break factor and resistance to tearing were obtained by using a cotton with a Micronaire reading of about 4.0 in the filling yarns, while maximum resistance to flex abrasion was obtained by using a cotton of 5.0 Micronaire reading in the filling yarns.

2426. DURABLE WASH-WEAR FINISHES FOR COTTON. Frick, J. G., Jr.; Andrews, B. A. K.; and Reid, J. D. Am. Dyestuff Reprtr. 51, P897-P900. 1962.

Theories on the hydrolytic stability of crosslinking finishes have led to the development of new agents for producing a highly durable wash-wear and wrinkle-resistance finish on cotton fabric. One of these agents, tris(N-methylol-2-carbamoyl-ethyl)amine, appears suitable for practical use. It can be prepared easily and can be applied by standard procedures. Finishing with this agent causes little susceptibility to chlorine damage and produces no more than the usual strength loss.

2430. RADIATION-INDUCED GRAFT POLYMERS OF CELLULOSE. Arthur, J. C., Jr.; and Blouin, F. A. Proc. Internatl. Symposium on Radiation-Induced Polymerization and Graft Copolymerization, sponsored by United States Atomic Energy Commission and Battelle Memorial Institute, Columbus, Ohio, November 29-30, 1962, TID-7643, pp. 319-34. (Republished as "Radiation-Induced Graft Polymers of Cellulose," Am. Dyestuff Reprtr. 52, 1024-27. 1962).

The mechanism of the interaction of ionizing radiation with purified cotton cellulose, a natural high polymer having a weight average molecular weight of about 700,000, was investigated. The major changes were depolymerization and the formation of reducing and acid groups. The principal gases evolved were hydrogen, carbon monoxide, and carbon dioxide. The presence of glucose, cellobiose, and a homologous series of cellulodextrins was determined. The formation



of 2-ketogluconic acid and possibly 2-ketocellobionic acid, and a similar homologous series, was also determined. At radiation dosages, where the fibrous properties of cotton cellulose were retained, the presence of activated molecular species was indicated by the reaction of vinyl monomers with cellulose both during and after irradiation to yield graft polymers, located within the growth layers and lumen of the fibers. Radiation-induced and ceric ion-initiated graft polymers of cellulose were further demonstrated by unextractable polymer add-on, decreased cellulose solubility, and decreased OH band intensity. The radiochemical yields of these reactions were dependent on experimental conditions and on prior chemical modification of the cellulose molecule. The graft polymers of fibrous cotton cellulose had increases in delayed elastic recovery, elongation-at-break, and resistance to setting and decreases in permanent set, stiffness, breaking toughness, and breaking strength. These changes in properties, particularly stiffness, elongation-at-break, delayed elastic recovery, and permanent set, indicated changes in molecular cohesion of the cotton cellulose molecules. The changes in molecular cohesion were related to the thermoplasticity of the graft polymers of fibrous cotton cellulose. Graft polymers of polystyrene-cellulose showed pronounced second order transition temperatures at 100° C. Graft polymers of polyacrylonitrile-cyanoethylated cellulose and polyacrylonitrile-cellulose showed transition temperatures at about 80°-100° C.

2431. RADIATION-INDUCED INTERACTION OF STYRENE WITH COTTON.

Demint, R. J.; Arthur, J. C., Jr.; Markezich, A. R.; and McSherry, W. F. Textile Research J. 32, 918-22. 1962.

The efficiency of activation and interaction of styrene with fibrous cotton cellulose was increased by the indirect effects of radiation-excited cotton and of methanol and N,N-dimethylformamide. The high radiochemical yields indicated that a chain reaction was initiated. The polystyrene was located within the growth layers of the fibers. The elongation-at-break and resistance to wetting of polystyrene-cotton were greater than that of cotton, and the average stiffness less. The polystyrene-cotton was thermoplastic.

2432. MICROSCOPICAL OBSERVATIONS OF ABRASION PHENOMENA IN COTTON.

DeGruy, I. V.; Carra, J. H.; Tripp, V. W.; and Rollins, M. L. Textile Research J. 32, 873-82. 1962.

Native and chemically-treated cotton fibers abraded by laboratory instruments and other means were examined by light and electron microscopy. Characteristic patterns of abrasion damage for a variety of experimental conditions have been established, and reasons are suggested for the abrasion response of the fibers. Marked differences were noted in the abrasion behavior of most cottons when tested in the dry and wet states, but these differences are minimized by resin treatments that crosslink the cellulose.



2436. SIMULTANEOUS APPLICATION OF COLOR AND OTHER SPECIAL PROPERTIES TO COTTON MATERIALS. Perkins, R. M.; Drake, G. L., Jr.; and Reeves, W. A. I&EC Product Research & Development 1, 281-85. 1962.

Wrinkle-resistance and color which are not removed by acid or alkaline treatment can be imparted to cotton simultaneously by treatment with aqueous solutions of compounds containing aziridinyl groups and mono- or dichlorotriazine dyes. The reactions take place in an acid system, and the reaction with aziridinyl derivatives is believed to involve two steps. Step one involves the formation of an immonium ion by protonation, and in step two the ring is opened by a suitable nucleophilic agent yielding the colored addition product. Simultaneous application of the dye and the crosslinking agent, both in the laboratory and the pilot plant, has resulted in brightly colored crosslinked fabrics which have durable colorfastness and wash-wear properties.

2437. PROGRESS REPORT ON THE EFFECT OF COTTON FIBER PROPERTIES AND SPINNING PROCESSING VARIABLES ON YARN PROPERTIES AND PROCESSING PERFORMANCE. PART I. THE RELATION OF FIBER STRENGTH. Waters, W. T.; Phillips, Joe; and Fiori, L. A. Textile Bull. 88, (12) 29-33. 1962.

From selected bales of low strength, medium strength and high strength cotton, a preliminary evaluation of the effect of fiber strength upon spinning performance and yarn properties has been made by an accelerated spinning technique. Five levels of fiber strength, two levels of yarn twist, and a range of spindle speeds were used in experimentally spinning 20/1 (30 tex.) and 40/1 (15 tex.) yarns. Preliminary results indicate that fiber strength has only a small effect upon spinning performance, and that this effect is greater at lower twist. The spinning variables of spindle speed and yarn twist have a much greater effect than fiber strength. Fiber strength increases yarn strength linearly.

2438. A NEW ELECTRONIC DEVICE FOR MEASURING THE UNEVENNESS OF THE CARD WEB AND FOR NEP COUNTING [PL-480 GRANT]. Barella, A.; Pujal, M.; and Viaplana, A. (Patronato "Juan de la Cierva" de Investigacion Tecnica, Barcelona, Spain). Textile Research J. 32, 428-30. 1962.

A new electronic device has been developed for measuring the regularity of the card web and for counting the neps. Roughly, the method is based upon the incidence of a light beam on the cathode of a photoelectric cell. The light beam passes through a sample of card web and the resulting electric impulse from the photocell goes, in succession, to an amplifier and to a recorder. The amplitude of the electric impulses depends on the optical density of the sample so that a wave-form tracing is recorded on appropriate paper. Such a graph will show web variation, and its analysis will lead to the determination of the regularity of the optical density or the web transparency. When the light goes through a nep, the impulse has a greater amplitude and its record shows a peak. Furthermore, the number of neps in the card web sample can be found through a special technique.



2440. COTTON SHEETING. WHAT FIBER FINENESS CAN DO TO IT. (Effect of cotton fiber fineness on physical properties of a type 128 sheeting. Part 4. Effect on the tensile properties and resistance to abrasion and tearing of bleached and dyed fabrics). Sands, J. E.; Little, H. W.; Fiori, L. A.; Mayne, S. C., Jr.; Mathews, W. T., Jr.; and Berkley, E. E. Textile Inds. 126, (12) 80-83, 85. 1962.

Fabrics were woven with selected combinations of fiber finenesses in warp and filling yarns, and a range of filling twists. Yardages of fabric representing all of the combinations were commercially finished through desizing, scouring, bleaching, and dyeing (vat color). A significant result is that warp and filling strip break factors, resistance to tearing and flex abrasion, and strip elongation are not appreciably affected by variations in fiber fineness over a practical range of Micronaire readings (3.0 - 4.5) used in commercial cotton mixes and range of filling yarn twists (3.6 - 4.2 TM).

2443. YARN UNTWISTING AS A RAPID TEST OF COTTON SWELLING IN VARIOUS REAGENTS. Carra, J. H.; Tripp, V. W.; and Orr, R. S. Textile Research J. 32, 1041-42. 1962.

A rapid test is described for studying the swelling capacity of cotton yarns in various reagents. The method should be useful in predicting the behavior of fabrics during chemical treatments for the modification of cotton.

2444. OXYLUMINESCENCE FROM COTTON TEXTILES. Pittman, R. A.; and Tripp, V. W. Textile Research J. 32, 1038-40. 1962.

A method of measuring the oxyluminescence of cotton is described. A number of modified and unmodified cottons were examined over the range 50°-200° C., and found to emit light. Plots of temperature vs. photometer deflection showed considerable differences for the samples examined. Apparent activation energies were calculated.

2445. REACTION OF ARYL ISOCYANATES WITH COTTON CELLULOSE. PART I: VARIABLES IN THE REACTION USING PHENYL ISOCYANATE. Ellzey, S. E., Jr.; and Mack, C. H. Textile Research J. 32, 1023-29. 1962.

The effects of time, temperature, concentration, solvent, and catalyst in the reaction between cotton fabric and phenyl isocyanate in organic solvents have been studied. The swelling power of the solvent for the modified cotton has been found to be quite important. Under the conditions used, the reaction lacks reproducibility, probably because of traces of moisture in the reaction system. Di-n-butyltin diacetate has been shown to increase substantially the rate of reaction of the isocyanate with cotton.

2446. REACTION OF ARYL ISOCYANATES WITH COTTON CELLULOSE. PART II: TEXTILE PROPERTIES OF FABRIC MODIFIED BY REACTION WITH PHENYL ISOCYANATE. Ellzey, S. E., Jr., Wade, C. P.; and Mack, C. H. Textile Research J. 32, 1029-33. 1962.

Cotton print cloth modified by reaction with phenyl isocyanate in either pyridine or N,N-dimethylformamide has slightly enhanced breaking strength and elongation. The treated fabrics show good rot resistance, but poor resistance to degradation by outdoor weathering. The isocyanate treatment gives a fabric of lower moisture regain and good stability to home laundering. For a given reaction, solvent degradation of the treated fabrics by chlorine bleaching and scorching bears an inverse relation to the nitrogen content of the fabrics in the range studied.

2447. THE UTILIZATION OF DIPLODIA-DAMAGED BOLL-ROT COTTON. PART I: EFFECTS ON YARN PROPERTIES AND SPINNING EFFICIENCY. Sands, J. E.; Fiori, L. A.; Groves, N. H.; and Marsh, P. B. Textile Research J. 32, 1013-22. 1962.

A limited quantity of specially selected seed cotton that has been damaged severely in the field by the common boll-rot fungus Diplodia sp. was roller-ginned and processed, along with a white control cotton, into blends containing 2.5%, 5.0%, 10.0%, and 35.0% by weight, of the Diplodia-damaged lint. The 35.0% blend could not be spun into a 38/1 (16 tex.) yarn without an excessive number of ends down. The 10.0% blend could be utilized more efficiently in coarser-than-38/1 (16 tex.) yarns. The 2.5% and 5.0% blends were spun into 38/1 (16 tex.) yarns without an excessive number of ends down. The yarns from these two blends did not differ significantly from yarns spun from the control cotton in length uniformity, appearance grade, or yarn breaking tenacity and elongation. All cases of reduced processing efficiency and product quality in any of the blends, in comparison to the white control, were shown to be related to the short fiber content of the blends. Diplodia-damaged and undamaged bolls occur regularly together within a single cotton field, with a resulting mixture of the two kinds of fiber in the bale. Field observations suggest that in commercial bales amounts of fungus-damaged fiber in excess of that represented by the experimental 5% blend here employed are rare.

2449. RECENT DEVELOPMENTS IN COTTON RESEARCH AT SRRL. Rusca, R. A. Proc. Southern Textile Methods & Standards Assoc. pp. 35-45. 1962.

The research program of the Southern Utilization Research and Development Division, New Orleans, Louisiana, to increase the utilization of southern agricultural commodities through the development of new and improved processes and products is briefly discussed and a number of recent achievements are outlined. Among these latter are cotton stretch yarns and fabrics, basic information on the effect of cotton fiber properties on yarn properties, and improved textile processing methods and equipment.



2450. EPOXOL 9-5, A REAGENT-RESISTANT ADHESIVE FOR ATTACHING SECTIONS TO SLIDES. Moore, A. T.; and Berni, R. J. Stain Technol. 37, 383-85. 1962.

In the investigations at this Laboratory involving microscopical observations of the swellability of cotton fibers in various liquids, it was found that typical adhesives used for attaching sections did not withstand the effect of various reagents. By applying Epoxol 9-5 (2) with ethanol borontrifluoride complex  $[(C_2H_5OH)_2 \cdot BF_3]$  as a catalyst, a sealing method was developed which allowed observations to be made on the cross sectional swelling of fibers in a series of reagents.

2451. MICROSCOPICAL PHENOMENA OBSERVED IN THE DEGRADATION OF COTTON CELLULOSE BY VARIOUS AGENTS. Rollins, M. L.; Porter, B. R.; Moore, A. T.; and Tripp, V. W. Proc. Intern. Congr. Electron Microscopy, 5th, Philadelphia, 1962, 1, BB-2, 2 pp. 1962.

Electron microscopy permits detailed investigations of the pattern of physical and chemical breakdown of cotton and other natural cellulose fibers. The mechanical stresses encountered in abrasion and wet beating are clearly reflected in the response of the fiber structure to physical forces. Because of the lamellar fibrillate structure of the fiber, cleavage often occurs parallel to the axis of the fiber by separation of layers in the cell wall or by separation of fibrils within the layer from the main body of the fiber. For effective separation of these structural elements, polar liquids are required. Crosslinking treatments applied to cotton inhibit this lateral cleavage. Sodium hydroxide of increasing concentration produces a progressive transverse swelling of the microfibril with corresponding shrinkage in length. The net effect is a crimping of individual microfibrils and this, in part, explains the increased bulk in mercerized fibers. Microbial action demonstrates that the effect of enzymolysis is similar to the action of mineral acids, resulting in the production of the characteristic particles of hydrocellulose. In comparisons of different types of oxidative deterioration, differences in pattern of breakdown can be observed between attack by periodic acid and by nitrogen dioxide. The effect of high energy radiation was essentially similar to that of oxidation.

2452. OBSERVATIONS OF CHEMICAL MODIFICATIONS OF COTTON FIBERS AT THE SUBMICROSCOPIC LEVEL. Moore, A. T.; and Carra, J. H. Proc. Intern. Congr. Electron Microscopy, 5th, Philadelphia, 1962, 2, W-6, 2 pp. 1962.

Some methods for detecting chemical and physical modifications of cotton fibers at the ultra structure level are presented. Chemical reactions involving the use of various reagents have been carried out on specimens mounted on carbon substrates and illustrations are given of processes involving deacetylation, location of crosslinking agents and distribution of polymers grafted to the cellulose.

## PATENTS

2453. PROCESS OF REACTING PARTIALLY SWOLLEN COTTON TEXTILES WITH AQUEOUS SOLUTIONS OF SPECIFIC ALDEHYDES CONTAINING ACID CATALYSTS TO PRODUCE WET AND DRY GREASE RESISTANCE. U. S. Pat. No. 3,046,079, July 24, 1962. Reeves, W. A.; Perkins, R. M.; and Chance, L. H.

An improved process for treating cotton textiles with formaldehyde. The instant process which involves controlled swelling of the cellulose fibers provides a method for reacting formaldehyde with cotton textiles without reducing excessively the strength of the cotton fiber. The cotton textiles treated by this process exhibit both wet and dry wrinkle recovery and are relatively nonshrinkable.

2455. AIR-BLAST DOFFER AND CONDENSER. U. S. Pat. No. 3,046,612, July 31, 1962. Kyame, G. J.; and Latour, W. A.

An improved doffer and conduit system design that yields even distribution of fibers on the condensers. The purpose of the device is to obtain uniformity in the batting delivered from the condensers.

2457. PROCESS FOR THE PRODUCTION OF ALKALI-SOLUBLE CELLULOSIC TEXTILE MATERIALS BY ETHERIFYING THE CELLULOSE WITH SPECIFIC ETHER GROUPS AND OXIDIZING WITH NITROGEN DIOXIDE. U. S. Pat. No. 3,052,511, September 4, 1962. Reinhardt, R. M.; and Reid, J. D.

A processing treatment for producing alkali soluble cellulosic textile materials. The cellulosic material is first chemically modified to a low degree of substitution and subsequently submitted to a highly effective oxidation step the latter carried out by the use of nitrogen dioxide either in gaseous or liquid phase, in solution, in an inert organic solvent, or generated from aqueous solutions or nitrite salts and aqueous acids.

2462. SILANE-SILICONE MIXTURE, METHOD OF PRODUCING THE MIXTURES; TEXTILE TREATED WITH THE MIXTURE; AND METHOD OF IMPREGNATING TEXTILE WITH THE MIXTURE. U. S. Pat. No. 3,065,111, November 20, 1962. Reeves, W. A.; Conner, C. J.; and Chance, L. H.

A unique combination of silane and silicone polymers prepared as mixed homopolymers useful for imparting a durable finish to organic textile fibers. Fabrics finished with the silane homopolymer silicone homopolymer mixture exhibit a high degree of water repellency and good resistance to water-borne stains. Textiles finished with the mixed homopolymers also exhibit improved resistance to abrasion and improved wash-wear properties. The textile finish is notably resistant to removal by laundering.



2463. CATION EXCHANGE STARCHES WHICH RETAIN THEIR ORIGINAL GRANULAR FORM AND PROCESS FOR MAKING SAME. U. S. Pat. No. 3,065,222, November 20, 1962. Bullock, A. L.; and Guthrie, J. D.

A method for crosslinking starch wherein the original granular structure of the starch is not destroyed. Crosslinking permits starch to be chemically modified with reagents and under conditions that would normally produce a nongranular dispersed material. Certain of the crosslinked and subsequently modified products disclosed herein are useful as ion exchange materials.





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